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Free access to multilingual digital books: a tool to increase book reading?

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The objective of the study was to examine how providing access to multilingual digital picture books affected the reading habits and language development of children from bilingual families. The study included 41 children aged 4−5 from two schools whose parents spoke a heritage language distinct from the environmental language (Dutch), and had a low level of education. The children were randomly assigned to two groups - one with access to digital books solely in the environmental language (Dutch) and the other with a choice between the environmental language and their heritage language. A general vocabulary test was administered before and after a six-week intervention period. The findings indicated that access to digital books motivated reading, with roughly one-third of the children reading a substantial number of books during the intervention. The availability of books in the heritage language did not lead to an increase in book reading. Given a choice, only a minority (33%) preferred to read in their heritage language. The conditions exhibited similar growth in vocabulary, but the study uncovered positive associations between the number of books and vocabulary development.

KEYWORDS

book platform, multilingual, digital picture books, multimedia, heritage language, book reading, bilingual families, kindergarten age

Introduction

Young children need a balanced media diet of stories, not just including cartoons (Wiederhold, 2019). Picture books, in particular, offer an ideal combination of visuals, sounds, and ample time for children to process and reflect on the narrative (Horowitz-Kraus and Hutton, 2017; Suggate et al., 2021). Exposure to picture books allows children to gain insight into the emotions and actions of others, thereby enhancing their understanding of social situations and emotions (e.g., Aram et al., 2017). Additionally, children's books ensure a dense and rich language input or, in Stahl's words, "children's books are where the words are" (Stahl, 2005, p. 100).

Regrettably, not all families have the means to obtain picture books to read to their young children early on, nor do all families have the interest or inclination to read to young children (Egan et al., 2022). Printed books may be expensive or unaffordable, and in some cases, there may be no libraries in the vicinity. Language barriers can also pose a challenge, as minority or immigrant families may not have books available in their heritage language. However, in the digital age, we have the opportunity to create platforms that address these obstacles and provide children with access to picture books at no cost, with the added benefit of being able to hear the

story in their preferred language. Digital picture books with voice-over options can be especially advantageous when parents have limited literacy skills or are not inclined to read to young children (Horowitz-Kraus et al., 2018; Tunkiel and Bus, 2022).

Our study focuses on whether the multilingual aspect of digital books can increase access to picture books in bilingual households (Orr et al., 2021). According to Barnes et al. (2022), reading in the heritage language can ease parents' worries about their pronunciation and prevent them from teaching their children incorrect pronunciation. Additionally, books in the heritage language can encourage hesitant parents to engage in book reading, as they may feel more confident in helping their child understand and enjoy the story. However, there is also evidence in the literature that parents may choose to use the dominant language in their environment, believing that it would improve their child's proficiency in the language required for academic success (Barnes et al., 2022).

According to Ma (2008, p. 248), despite receiving a bilingual education, children may still prefer books written in the environmental language due to its perceived higher status (see also Yoon, 2019). Additionally, bilingual children may experience more severe difficulties in comprehending stories in their heritage language compared to the environmental language. Hammer et al. (2014) demonstrate that they have limited vocabulary in each language, but frequent use of the environmental language in their daily interactions, such as at preschool or kindergarten, may mean they are less behind in the environmental language compared to their heritage language (Flores et al., 2019; Hoff et al., 2021). Despite being somewhat familiar with their heritage language, bilingual children may still not have the necessary proficiency to understand complex literary picture books in that language.

Although research on the benefits of access to books in multiple languages is limited, some studies suggest that reading stories in a child's heritage language can have a positive impact not only on their proficiency in the heritage language but also on their environmental language abilities, contrary to the belief that reading in the environmental language is necessary for that. Several studies (Eisenworth et al., 2018; Daly, 2021; Cun, 2022; Luo and Song, 2022; Pico and Woods, 2022; Shen and Del Tufo, 2022) support this claim. For instance, the German study conducted by Eisenworth and colleagues showed that reading stories in Turkish, the heritage language of the targeted immigrant children in this study, improved their proficiency in German, their environmental language.

There are several possible reasons why reading books in a family's heritage language can have positive effects on proficiency in the environmental language. Firstly, reading in the heritage language can help children become familiar with the narrative structure of stories, which can aid in comprehending new stories in the environmental language when they start attending school or early education centers. This can promote a better understanding of the environmental language within the story (Cummins, 2000; Bergman Deitcher et al., 2021). Secondly, exposure to complex vocabulary in literary works in the heritage language can also help children understand the same words in the environmental language (Cummins, 2000). Finally, book in the heritage language can encourage parental involvement in their child's language development (Wofford and Tibi, 2017; Barnes et al., 2022), which can facilitate the transition to the environmental language when the child starts school (Anderson et al., 2017).

Sardes, a Netherlands-based organization, is dedicated to improving the language and literacy abilities of young bilingual children. To enhance the Home Literacy Environment, Sardes partnered with app designer Het Woeste Woud to create a digital platform of picture books for bilingual children aged 4–5 years old. The experimental platform enables families with at least one parent fluent in Tamazight, Turkish, or Arabic to access books easily, with the option to choose between their heritage language and the environmental language (Dutch). The main goal of this project is to determine whether multilingual digital picture books increase the frequency of at-home book reading and improve children's development in the environmental language. Additionally, the project seeks to identify strategies that can improve the platform's effectiveness (Zhang et al., 2021; Tatar and Gerde, 2022).

Research questions

1. Does the availability of digital picture books in a family's heritage language at home encourage parents to participate in reading books with their children outside of school, resulting in an increase in at-home book reading?
   Books in the heritage language may encourage parental involvement in their child's language education and foster greater enjoyment in book reading.
2. Do bilingual families tend to prefer reading digital picture books in their heritage language or their environmental language when given a choice?
   Parents may opt to read books in their heritage language to make communication easier, but they may give greater importance to reading in the environmental language to improve their child's language abilities in that language and support academic success. Bilingual children may also show a preference for reading in the environmental language because they have a better grasp of that language and are more familiar with understanding stories in that language (Kolancali and Melhuish, 2021).
3. Can children's proficiency in the environmental language be enhanced by reading more books, even if the books are written in their heritage language?
   While reading books in either the environmental or heritage language can have a positive impact on the environmental language, as noted by Eisenworth et al. (2018), the impact may be more significant when children primarily read books in the environmental language.

Methods

Participants

The research took place in two city schools, A and B, situated in neighborhoods where multilingual and low-educated families predominantly work in service industries like cleaning, construction, and home care. Only 4–5-year-old students from families with at least one parent who spoke Turkish, Tamazight, or Arabic were considered eligible for participation. It is unclear whether the families were more dominant in Dutch or their heritage language (Luo et al., 2020). Participants were selected based on parental consent, and the data analytics were collected according to strict guidelines:

TABLE 1 Characteristics of the 41 participants [numbers or mean (standard deviation)].

	Total	Only access to environmental language	Choice between environmental and heritage language
Age in months	61.54 (6.60)	60.00 (5.10)	63.08 (7.74)
Sex (M/F)	18/23	8/13	10/10
School (A/B)	17/24	9/12	8/12
Turkish	10	4	6
Tamazight	20	12	8
Arabic	11	5	6
Sentence Comprehension (pretest, max = 12)	7.54 (2.10)	7.48 (2.09)	7.60 (2.16)
Active Vocabulary (pretest, max = 24)	10.90 (4.92)	11.57 (4.99)	10.20 (4.87)

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Research design

All 41 participants were given access to a digital book platform containing 10 books for a period of 6 weeks. Half of the participants had the option to choose books in their heritage language or Dutch, while the other half only received books in the environmental language (Dutch). We randomly assigned the children to the two groups, with the caveat that both groups had a similar representation of schools and the three heritage languages (Tamazight, Turkish, and Arabic). Prior to and following the intervention, the participants' proficiency in Dutch was assessed using two sub-tests from the Clinical Evaluation of Language Fundamentals (CELF) test (Wiig et al., 2013). The results in Table 1 revealed no noteworthy discrepancy in pretest scores on Sentence Comprehension or Active Vocabulary between the two groups. Throughout the intervention, data analytics were collected to better understand how the platform was being used.

Book platform

The digital book platform provided by the app designer (Het Woeste Woud) featured 10 high-quality picture books summed up in Appendix 1. The books appeal to young children, with themes such as sibling jealousy, losing a stuffed animal, homesickness, and a parent not having time for play. The narration and illustrations were designed to complement each other in various ways (Sipe, 2008). Most narrations include a sophisticated vocabulary and complex grammar (Logan et al., 2019). The digital books were designed with the option for a parent's presence being optional (Guernsey, 2017). Each of the 10 books featured voice-over readings in Dutch, Turkish, Tamazight, and Arabic, ensuring correct pronunciation and diction.

The books also included multimedia features that have been shown in previous research to aid in comprehending the story and

learning new vocabulary (Sarı et al., 2019; Bus and Anstadt, 2021; Sun et al., 2022). The designer of the app integrated various elements such as motion, zooming, panning, environmental sounds, and music that are consistent with multimedia learning principles, including the temporal contiguity and self-explanation principles (Bus et al., 2015; Yang et al., 2022; Bus and Hoel, 2023).

The stories were presented in a cinematic style (Verhallen et al., 2006) but readers had the ability to pause the story at any point. The stories ranged in duration from 4 to 7 min and were accessible in four different languages. Professional translators were tasked with translating the stories, and voice actors recorded the spoken text. The app designer adapted the Arabic reading orientation, and users could switch between languages easily by clicking on the flag icon on the start screen where they selected a book. According to data analytics, all users who had the option to choose a language utilized this feature. During interviews, both the children and their parents reported no difficulties associated with this functionality.

Language tests

Before and after the six-week intervention period, all 41 participants were assessed using two sub-tests from the Dutch version of the Clinical Evaluation of Language Fundamentals (CELF) test: the Sentence Comprehension and Active Vocabulary sub-tests (Wiig et al., 2013). The Sentence Comprehension sub-test involved matching pictures to spoken sentences, while the Active Vocabulary sub-test required naming pictures of objects and actions. The first 12 items from each sub-test were used, with maximum scores of 12 and 24, respectively. The tests' reliability was considered acceptable, with the Sentence Comprehension pre-test at an alpha reliability of 0.65, Sentence Comprehension post-test of 0.84, Active Vocabulary pre-test of 0.75, and Active Vocabulary post-test of 0.85. However, the Sentence Comprehension test indicated minimal improvement because the pre-test scores were relatively high.

Interviews

The topics that were covered in the discussions with eight children who volunteered to share their experiences included their favorite stories, how they use the platform (such as the time of day and device

they use), any problems they faced (such as switching between languages) and who assisted them in resolving those issues, and their preferred way of reading (such as alone, with siblings, or with a parent) and the language they preferred.

During the discussions with eight volunteering parents, various themes were covered such as their child's reading habits, including the time and device used for reading, whether the child reads alone or with others, the language they preferred the most, who makes the decision regarding the language to read in, and the parent's preferred language for reading and the rationale behind their preference.

Data analytics

Data was automatically gathered on several metrics such as the frequency of the children's visits to the platform, the number of books they read per session, the specific titles they read, and the language they read them in.

Sessions

If a user visited the platform multiple times on the same day, we considered each visit as a separate session. The score was not normally distributed (positive skewness), but none of the transformations improved normality.

The number of books

We recorded the number of books read by counting how many books were displayed on screen for 3–15 min, assuming that a child had read the entire book if it was on screen for that duration. We successfully winsorized the scores and used a square root transformation to improve normality ($W = 0.95673, p = 0.3313$).

Titles

We also recorded the number of distinct books read at least once. Transformations could not improve the negative skewness.

Duration

We calculated the time between the first login and the last visit to the platform.

Language

For each book, it was coded in which language it was read.

Procedure

At the start of the experiment, all parents of eligible children were provided with an explanation of the book platform and its potential benefits for their children's language development. We collected data when written consent was obtained from parents, but access to the platform was also given to those who did not consent to data use or whose children did not meet the study's criteria. At a school session, parents were given assistance in installing the platform on their preferred device, and were familiarized with the option to switch languages. They were also encouraged to read the stories together with their children (Konca and Tantekin Erden, 2021; Pico and Woods, 2022).

During the first 3 weeks, platform usage was monitored and parents were reminded by the teacher to visit the platform if data

analytics showed they had not done so. Individual testing of children was conducted at school by a researcher or teaching assistant before and after the six-week intervention, with each session lasting about 10 min. The individuals conducting the tests were unaware of which experimental condition the child had been assigned to. Additionally, interviews were conducted with eight parents and eight children to obtain further information about their experiences with the platform, including their preferred language, who initiated reading, and whether the parent joined in the reading sessions.

Data diagnostics and analytical strategies

The analyses were conducted only on the 26 participants who had utilized the platform. Fifteen participants had failed to activate it. To evaluate the normality of the number of books, number of different titles, number of days visiting the platform, and language growth, we utilized the dplyr and ggpubr packages, which involved examining the density plot and Q-Q plot and conducting Shapiro–Wilk's normality tests. To normalize the scores on the number of books and titles, we performed a square root transformation, and we also applied winsorization to three extreme scores on the number of books. As there was limited improvement observed in the Sentence Comprehension test, possibly due to the high pre-test scores, we decided to focus on analyzing the growth shown in the vocabulary test, which had a normal distribution. We conducted independent t-tests using the base R package to compare the number of read books, titles, and language growth across different conditions. We employed a chi-square test using the stats package to compare the frequency of platform visits, distinguishing between those who visited one or 2 days versus those who visited more frequently.

We also investigated the association between the number of read books and language growth. We first assessed whether Cook's distance, tolerance, and VIF met the requirements for multiple regression for vocabulary growth. Using the package moonBook, we fitted linear regression models by regressing language growth on the total number of books in the first regression and on the number of books in the environmental and heritage language in the second regression.

Results

According to the data collected from the multilingual digital book platform, not all families visited the platform despite receiving reminders from their teachers. Out of the 41 initial participants, 15 did not visit the platform once and were subsequently excluded from further analyses. The remaining 26 participants who did use the platform were split evenly between the two conditions: 14 children had the option to listen to books in either their heritage language or Dutch, while the other 12 only had access to Dutch books.

Effect of heritage language on book reading

After applying a square root transformation and winsorizing, there were no significant differences in the number of books read between the two experimental groups, $t = -0.35, df = 24, p = 0.3629$.

TABLE 2 Descriptive statistics regarding number of books, titles, period, and children's language skills (% or mean/standard deviation).

	Total	Only access to environmental language	Choice between environmental and heritage language
Number of books (winsorized)	21.46 (18.45)	22.17 (17.77)	20.86 (19.67)
Number of titles (max = 10)	7.00 (3.33)	7.42 (3.12)	6.64 (3.59)
Visiting the platform for no more than 1 or 2 days	38%	17%	57%
Vocabulary growth	1.88 (2.82)	1.75 (2.86)	2.00 (2.88)

The number of books read varied from none (if none of the books had been long enough on screen to be read completely) to 290. As shown in Table 2, the mean number of books read was 22 for children with access to Dutch stories and 21 for those with a choice of languages, after winsorizing the scores. The number of different titles read was also similar across the two groups. As shown in Table 2, children who had access to stories in their heritage language read an average of 6.64 different titles (SD = 3.59), while those who only had access to Dutch books read an average of 7.42 different titles (SD = 3.12).

Our expectation was that the availability of books in their heritage language would encourage parents to read more frequently with their children. Despite the availability of books in multiple languages, interviews indicated that parental involvement was low. Interviews with children indicated that reading was typically done alone or with siblings, and parental participation was infrequent. While some parents reported joining their child occasionally or discussing the stories afterwards, it was clear that they preferred to let their children explore the platform independently, as the children were capable of using it on their own.

Among the 26 children, 10 of them had utilized the platform only once or twice and had read a limited number of books and titles. Notably, as Table 2 shows, the tendency for short-term usage was more common among children who had the option of selecting languages (57%) than those who only had access to Dutch books (17%). This difference did not reach statistical significance, although Fisher's exact test approached significance (p = 0.051). Some children who were given the choice to listen to stories in their heritage language may have found them difficult to understand, which could have discouraged them from visiting the platform. Alternatively, the translations may not have been of sufficient quality, despite our efforts to ensure high standards. We talked to parents about the quality of the translations for the heritage language stories, but they did not express any dissatisfaction.

Book comprehensibility

Based on the even distribution of the most active readers (who read 21 or more books) across both conditions ($\chi^2 = 0.13$, $df = 1$, $p = 0.7157$), it seems that access to the heritage language did not significantly affect reading habits. Instead, the difficulty level of the books may have been a more crucial factor. We observed a significant difference in the popularity of the books, with Little Kangaroo being the most popular, having been read a total of 164 times, followed by Elephant and Crocodile and Pete on the Tiles, which were read 124 and 113 times, respectively. The other books
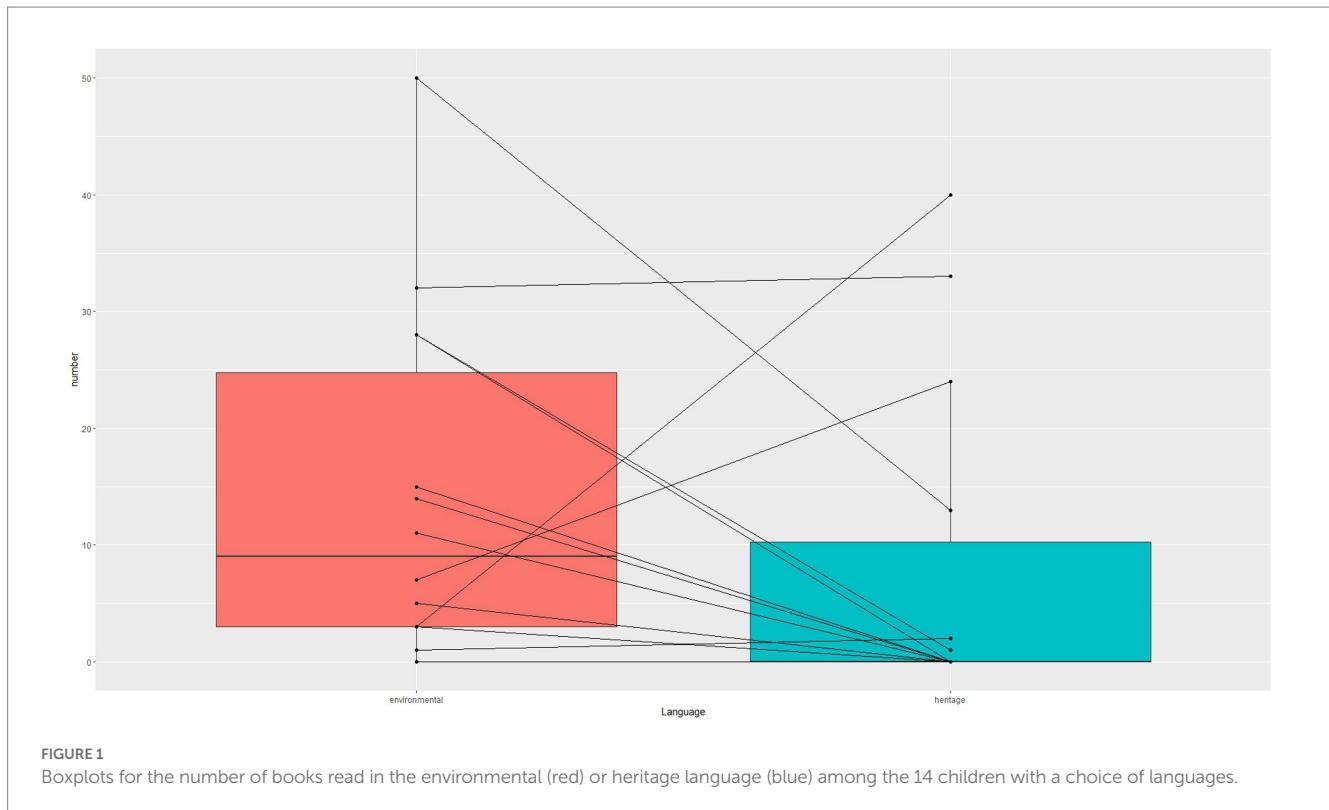
were read between 50 and 80 times. The repetitive structure of Little Kangaroo, in which a mother kangaroo tries to persuade her young to leave her pouch by showing a series of attractions in the outside world, may have turned it into the most easily understandable book and, therefore, more appealing to the children. The other books included more complex plots, which could have discouraged children with limited language skills and caused them to stop visiting the platform.

Language preference

Paired boxplots were created using the ggpubr package to demonstrate language preference, as shown in Figure 1. The data used for Figure 1 was collected from the group of 14 children who had access to both their heritage language and the environmental language. However, it was not possible to determine the preference of two of the 14 participants as they did not complete reading any books. The boxplots reveal that, on average, the remaining 12 participants read more books in Dutch than in their heritage language. The left red boxplot represents the number of books read in Dutch, while the right blue boxplot represents the number of books read in the heritage language. Despite this, there was no statistically significant difference in book preference, as indicated by a t-value of −1.16 with a p-value of 0.2662 and 13 degrees of freedom.

Based on the data, it appears that out of the 12 children in the group that had the option to choose between their heritage and environmental languages, eight preferred reading in Dutch, as shown by the decreasing lines in Figure 1. Overall, this group did not read a lot, with the majority reading less than 20 books in Dutch and only a few (<5) in their heritage language. Out of the children who read mainly in Dutch, only three of them read more than 25 books, and one of these children also read 13 books in their heritage language. Out of the 12 children, four displayed a preference for reading in their heritage language, as indicated by the rising lines in Figure 1. Two of these children read a considerable number of books (>20) in their heritage language and very few in Dutch, while one child read a substantial number in both languages, and the fourth child read few books in both languages.

During interviews, more information was gathered regarding why only a small percentage of children chose to read in their heritage language. Some children mentioned feeling more comfortable with the language spoken in their environment, even though they grew up in a bilingual household. For example, one child stated, "I prefer Dutch over my mom's language. I understand Dutch better." Parents also expressed actively encouraging their children to read in Dutch, as it is the language used in school. One mother explained, "It's important for my son to hear

FIGURE 1
Boxplots for the number of books read in the environmental (red) or heritage language (blue) among the 14 children with a choice of languages.

stories in Dutch because he speaks a lot of Tamazight at home. His father only speaks Tamazight, so I always choose the Dutch version, even if the Tamazight version is available. I want him to learn Dutch. I do not want him to speak Tamazight." However, some parents expressed a desire for their children to learn their heritage language and were enthusiastic about the platform offering books in that language. For example, one mother expressed disappointment that her child did not have access to books in Tamazight, and one child mentioned preferring Dutch over Arabic but enjoying reading in Arabic with her mother.

Language growth

The growth in the environmental language was similar between the two conditions (only Dutch or a choice), with no significant difference observed ($t = 0.22$, df $= 24$, $p = 0.5866$), which is not surprising since they read a similar number of books. To investigate the relationship between language growth and the intensity of book reading, as measured by the number of books, a regression analysis was performed to determine whether the number of books could predict language growth. To visualize and test the relationship between language growth and the number of books read, we regressed language increase on the number of books. The outcomes confirmed the hypothesis that reading books enhanced vocabulary development in Dutch. After accounting for gender disparities, the study discovered that the number of books read predicted language growth (estimate $= 0.47$, $se = 0.21$, $t = 2.23$, $p = 0.036$), as shown in Figure 2. After accounting for the number of books, the adjusted R-squared increased from 0.15 to 0.27, indicating that a greater number of books during the intervention period is associated with an additional 12% increase in vocabulary growth.

In addition, we also examined how reading in the heritage language and the environmental language affected the results. The results in Figure 3 indicated a positive correlation between reading in the heritage language and language growth (estimate $= 0.11$, $se = 0.06$, $t = 1.92$, $p = 0.0841$), while reading in the environmental language did not demonstrate a significant correlation (estimate $= 0.01$, $se = 0.06$, $t = 0.15$, $p = 0.8834$). Interestingly, the group favoring reading in their heritage language showed most growth in the environmental language. This unexpected finding indicates that these children may have had a particular interest in language-related tasks. Likewise, the fact that three children from the group that favored the heritage language were also the most avid readers serves to strengthen this observation.

Discussion

Main findings

Our research did identify that a significant proportion of children appreciated having access to a book platform. Approximately one-third of the participants read an impressive number of books, with a median of 38 picture books over 6 weeks. Furthermore, our findings support the notion that reading books has a beneficial effect on children's language development, particularly for the minority of children who favored reading in their heritage language.

Our study did not provide evidence to support the primary objective of the research, which was to determine whether a digital book platform with multilingual content would result in higher rates of book reading among low-literacy, bilingual families compared to a platform containing books only in the environmental language.
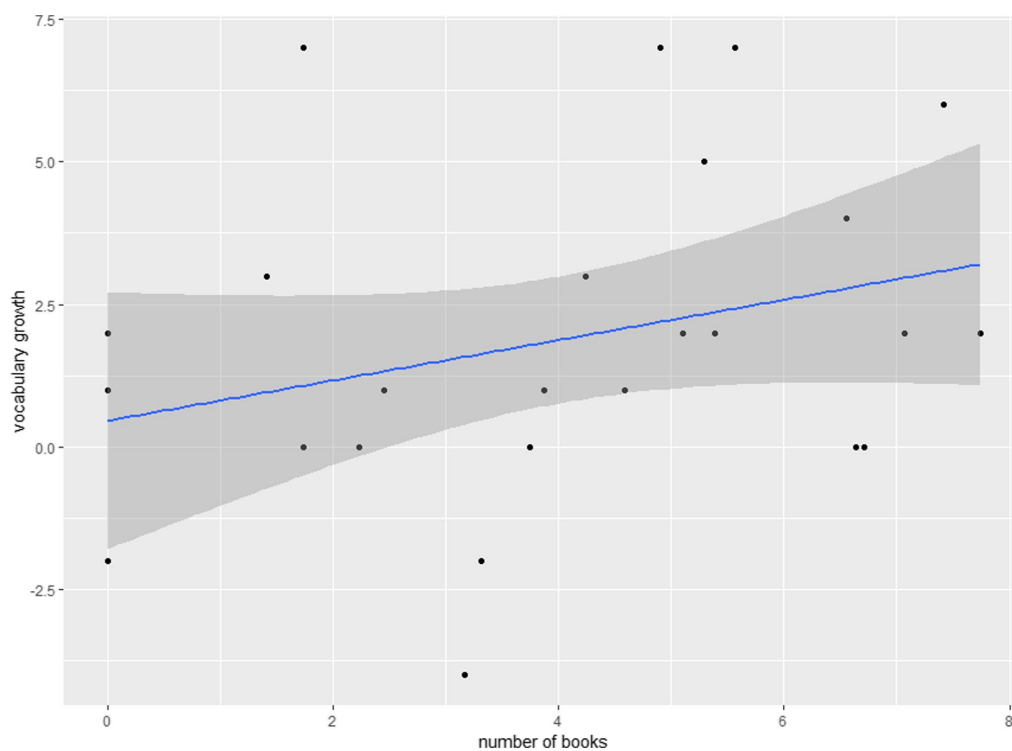
FIGURE 2
Relationship between vocabulary growth (y-axis) and the number of books (x-axis). Since a square root transformation was applied to the number of books, the values on the x-axis do not correspond to actual numerical values.

We found that both approaches resulted in similar numbers of books read and as much improvement in the environmental language.

As previously reported (Fitton et al., 2018; Gao et al., 2020), our study found that most children with access to books in their heritage language preferred books in the environmental language. Nevertheless, a unique result of this research is that a significant portion of the participants, one-third of the group, demonstrated a preference for books in their heritage language. Therefore, while a multilingual digital book platform may not be preferred by the majority, our study highlights the importance of providing access to books in the heritage language for a sizeable proportion of bilingual children.

Heritage versus environmental language

The objective of the book platform was to tackle the language difficulty that children of immigrant backgrounds encounter when trying to understand picture books. Our approach to attaining this goal involved providing young children with the chance to read books in the heritage language spoken at their home. The findings of our study indicate that the majority of reading occurred in the environmental language, which aligns with previous research on immigrant families. These studies have demonstrated that despite not being proficient in the environmental language, parents often choose to read to their children in that language (Barnes et al., 2022, for example).

The interviews conducted during our research revealed that many children preferred reading books in the environmental language because they felt they lacked sufficient knowledge of their heritage language to understand the literary, flowery text typical of picture books (Flores et al., 2019; Hoff, 2021; Hoff et al., 2021). Additionally, some parents mentioned choosing the environmental language as they believed it would improve their children's chances of academic success (*cf.*, Barnes et al., 2022). However, we did not gather enough information about the children who read a significant number of books in the heritage language to determine the factors behind their preference. It is possible that these children belonged to families where the heritage language was more dominant, resulting in their greater proficiency in that language (Luo et al., 2020).

Overall, our study confirms that bilingual children and their families differ in their language preference when it comes to reading picture books. Further research is necessary to uncover the reasons behind children's inclination toward reading in their heritage or environmental language.

Reasons for not or rarely visiting the platform

In addition to the possibility of parents being occupied and overlooking the material, the learning approach could have also played a role in neglecting the program. The parents' unfamiliarity with mobile educational apps as an effective learning tool (Papadakis and Kalogiannakis, 2017) and their negative reputation might have contributed to their reluctance to motivate their children to use the platform, despite the school's strong recommendation.

In addition, it is possible that some participants were discouraged from using the platform due to the difficulty level of the available
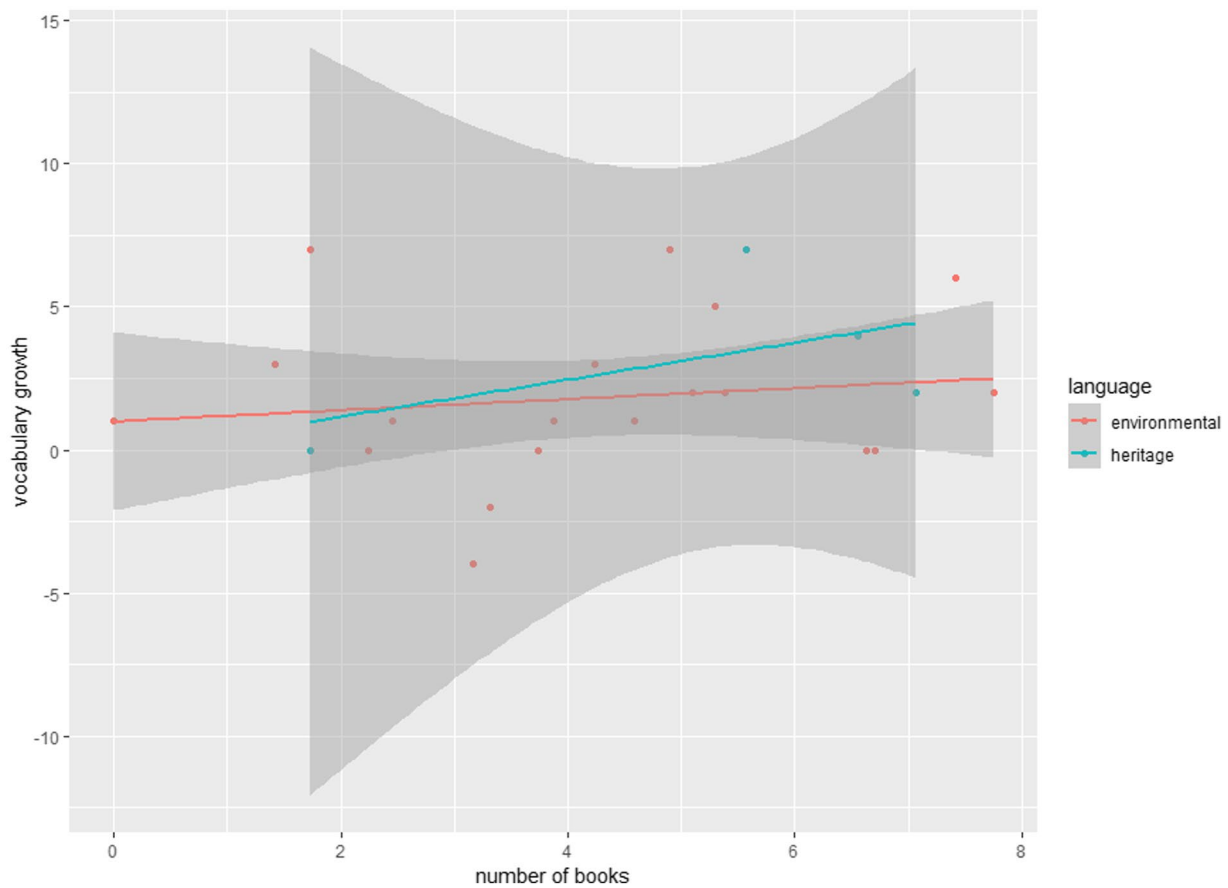
FIGURE 3
Relationship between growth in vocabulary (y-axis) and the number of books (x-axis) for children with a preference for the environmental language (red) and a preference for the heritage language (blue). Since a square root transformation was applied to the number of books, the values on the x-axis do not correspond to actual numerical values.

books. Hammer et al. (2014) noted that young multilingual children often have smaller vocabularies in each language compared to monolingual children, and their language proficiency may not have been sufficient to comprehend age-appropriate picture books. The fact that most children did not read all 10 books at least once suggests that they may have found the stories too challenging to understand. Interestingly, the book we identified as the easiest, "Little Kangaroo," was also the most frequently read. Should this conclusion be upheld, it would contradict the Fitton et al. (2018) finding that a minimum level of language proficiency is unnecessary. Further research is required to explore the impact of the difficulty level of books on the reading behavior of bilingual children.

The platform's infrequent use could also be attributed to the fact that digital picture books are usually read independently, without adult supervision, as observed by Guernsey (2017). Although we lack specific data on whether the children received assistance from adults while reading, our interviews with them strongly suggest that they primarily read independently or with siblings, rather than with a parent. As one of the reviewers of this article pointed out, it may be unrealistic to expect young and inexperienced children to develop reading habits on their own without adult guidance and initiation.

Limitations and future directions

Like any study, this research has its limitations that warrant further exploration. One of the limitations concerns the coding of the number of books read. We assumed that if there was a gap of more than 15 min between two listening sessions, the child had stopped reading the book. However, it is possible that some children listened to the entire book and only left afterward. Therefore, our method may have underestimated the actual number of books read, especially for children who revisited the platform frequently and read one or two books at a time.

Another limitation is the sample size, which was relatively small and further reduced by the low participation rate, as around one-third of the participants did not use the platform. Therefore, additional replications with a larger sample size are necessary to more thoroughly examine how multilingual books affect children's book reading and language preferences.

New research may benefit from gathering more information about the participants. For example, since we did not assess the children's proficiency in their heritage language, it is difficult to determine whether a preference for the environmental language was due to a lack of proficiency in the heritage language.

Additionally, as one of the reviewers pointed out, we may have inadvertently influenced parents toward a preference for the environmental language by highlighting the platform's potential to improve their children's Dutch language skills. This emphasis on Dutch language development may have led parents to prioritize the environmental language over the heritage language.

It remains unclear from the study what motivates children's language preferences and the extent of their parents' influence in this decision. Conducting interviews with a larger sample of both children and parents could provide valuable insight into this issue.

And finally, while the study suggests that reading more books may improve language development, the correlation found does not establish causation. To obtain more robust evidence, an experimental design could be implemented, including both children with and without access to a digital books platform.

Conclusion

The study aimed to assess the effectiveness of a multilingual digital book platform in encouraging reading habits among bilingual children from low-literacy backgrounds. The results indicate that around 33% of the participants read a substantial number of books at home during the six-week trial, which may have contributed positively to their Dutch vocabulary. The study also uncovered some surprising outcomes, including a minority of children who preferred reading in their heritage language. Nonetheless, the provision of multilingual books was deemed significant, as a third of the children primarily read books in their family's heritage language and appeared to derive pleasure from it, based on their book consumption.

Minor adjustments to the platform, such as simplifying the language or offering stories with less complex plots, could enhance its effectiveness. Previous studies by Hall et al. (2018), Tatar and Gerde (2022), and Zhao et al. (2022) suggest that establishing a regular routine for accessing the platform may be beneficial. To establish such a routine, it may be necessary to involve Early Education Centers, as suggested by Bierman et al. (2019) and Hummel et al. (2023). Collaborating with teachers could also encourage parents to read the same books at home as are read in school.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The study involving human participants was reviewed and approved by Sardes. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

AB: conceptualization, methodology, data curation, data analysis, and writing—original draft preparation. KB: conceptualization, recruitment, data collection, and review and editing. KV: recruitment, project administration, data collection, and review and editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix 1

Picture books on the digital book platform, digitized and animated by Het Woeste Woud, NL.

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