



The print exposure of teacher candidates in relation to their achievement and self-ratings of early reading experiences

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Abstract

This study examined the print exposure of teacher candidates ($N = 195$) in relation to their GPAs, achievement in reading and writing on the SAT, and their self-ratings of their own early (K to Grade 5) reading experiences. Participants came from undergraduate and Masters programs in varied certification areas and from two different universities. Print exposure measures included author recognition tests for both fiction and nonfiction; a questionnaire about participants' current voluntary reading habits for books, magazines, newspapers, and digital print media; and favorite authors/books questions. Exploratory factor analysis suggested four factors underlying the different print exposure measures: (1) fiction book reading volume; (2) current magazine and newspaper reading; (3) nonfiction book reading volume and (4) current book reading habits for enjoyment. Only fiction and nonfiction book reading volume related positively to participants' achievement, in writing as well as reading, and to their early reading experience ratings. A subgroup of participants who had taken a specific reading methods course involving structured language content, and who had positive early reading experience self-ratings, had higher performance in the course than did participants with mixed or negative self-ratings, although the two groups did not differ in overall GPA. Findings support the view that different measures of print exposure tap somewhat different aspects of print exposure, with differing relationships to varied indicators of achievement. Results also support concerns about the reading volume and print exposure of some teacher candidates.

Keywords Print exposure · Reading · Reading habits · Teacher candidates · Teacher preparation · Writing

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Introduction

Print exposure is known to play an important role in reading development. Even in preschoolers, print exposure through parental read-alouds influences children's acquisition of vocabulary and language (Mol & Bus, 2011; Scarborough & Dobrich, 1994), because books tend to expose children to more academic language and unusual words than are typically used in everyday conversation (Hayes & Ahrens, 1988). As children begin formal schooling and develop basic reading skills, their own reading of texts—independently or with scaffolding from adults—helps them develop fluent reading (Foorman et al., 2016). Furthermore, print exposure accounts for unique variance in word identification and spelling even after controlling for phonological skills (Stanovich & West, 1989), suggesting that print exposure contributes to additional growth in these areas. Many other studies demonstrate positive relationships between print exposure and growth in reading comprehension (e.g., Anderson, Wilson, & Fielding, 1988; Cunningham & Stanovich, 1997; Guthrie, Wigfield, Metsala, & Cox, 1999; Sparks, Patton, & Murdoch, 2014). Well into adolescence and later adulthood, print exposure may contribute to the continued development of reading comprehension and overall verbal cognition (Stanovich, 2000).

Previous studies have often focused on concurrent relationships between print exposure and reading-related abilities (e.g., Spear-Swerling, Brucker, & Alfano, 2010; Mar & Rain, 2015; Stanovich & West, 1989), or on using print exposure measures to predict later reading or verbal ability (e.g., Anderson et al., 1988; Cipelewski & Stanovich, 1992). However, print exposure and reading appear to have a reciprocal or bidirectional relationship. That is, early success in learning to read fuels increases in amount of reading, and increased print exposure then contributes to further gains in reading achievement, in an ongoing cycle across development. Early difficulties in reading have the opposite effect, creating a dynamic of “rich-get-richer, poor-get-poorer” effects (Stanovich, 1986). Longitudinal studies have shown that first-grade success in learning to read is a strong predictor of later print exposure (Cunningham & Stanovich, 1997; Sparks et al., 2014). Similarly, Acheson, Wells, and McDonald (2008) demonstrated that college students' scores on the reading and English portions of the ACT, a standardized test widely used in college admissions, predicted higher performance on several measures of print exposure given several years later, when the students were in college. A comprehensive meta-analysis by Mol and Bus (2011) obtained results consistent with a bidirectional relationship between reading achievement and print exposure: Print exposure contributes to reading growth, but growth in reading also contributes to print exposure.

Although most investigations of print exposure have focused on reading, frequent pleasure reading is also associated with higher writing achievement (National Endowment for the Arts [NEA], 2007). Many reading-related abilities known to be promoted partly through print exposure—such as vocabulary, spelling, and background knowledge—impact writing as well as reading. For example, spelling is an important component of written expression that helps to provide a foundation for the development of more advanced written expression abilities (Graham et al., 2012); vocabulary and background knowledge may impact text generation

(i.e., composition) aspects of writing (Berninger et al., 2006). Also, print exposure through wide reading may increase avid readers' exposure to good text models for writing, as well as their familiarity with different paragraph and text structures (Graham & Hebert, 2010). Skills and knowledge gained through wide reading experience may spur improvements in writing achievement, with the same "rich-get-richer, poor-get-poorer" effects as for reading. Furthermore, these relationships may be bidirectional, with increased print exposure spurring subsequent gains in writing, and higher writing achievement then spurring further increases in print exposure.

Given the importance of print exposure in literacy development, concerns about overall declines in voluntary pleasure reading in recent decades (International Reading Association [IRA], 2014; NEA, 2007) are worrisome, although some surveys (NEA, 2009, 2019) do suggest an encouraging increase for adults in certain kinds of pleasure reading, such as fiction and poetry. Another survey (Huang, Capps, Blacklock, & Garza, 2014), focused specifically on college students, showed that the most popular type of recreational reading involved online reading materials. This study also suggested that part-time jobs and online activities such as participation in social-networking sites might tend to decrease time spent both on reading for school and voluntary pleasure reading. Similarly, Mokhtari, Reichard, and Gardner (2009) found that many college students preferred online activities to conventional recreational reading such as reading of books. Furthermore, some studies (Applegate & Applegate, 2004; Nathanson, Pruslow, & Levitt, 2008) have raised concerns about high levels of "aliteracy," a lack of interest in pleasure reading despite adequate reading ability, in teacher-education students specifically. "Aliteracy" in teacher candidates is particularly worrisome, because scholarly panels (e.g., Snow, Griffin, & Burns, 2005) agree that teachers need to be able to model an interest in reading for their students; moreover, familiarity with books can be an important resource for educators in teaching reading (Kozak & Martin-Chang, 2019), and perhaps writing as well. To understand these issues, adequate measurement of print exposure is essential.

Measurement of print exposure

Although agreement on the importance of print exposure is virtually universal, measurement of print exposure has proven somewhat challenging. Besides self-report surveys and reading habits questionnaires, investigators have asked participants to regularly record the amount of time they spend reading (e.g., Anderson et al., 1988). Other studies have used participants' self-reports of amount of time spent reading or writing, independent of activity diaries (e.g., Acheson et al., 2008). Studies of preschoolers have sometimes used parental reports of frequency of shared book reading as indicators of children's print exposure (e.g., Zhang et al., 2018). However, an important limitation of all self-report measures involves the fact that the measures may be influenced by social desirability effects, or the tendency for participants to answer questions in the way they believe is socially desirable rather than completely accurate.

These problems with self-report measures led to the development of checklist recognition measures for assessing print exposure (Allen, Cipielewski, & Stanovich, 1992; Stanovich, 2000). Checklist recognition measures provide participants with lists of book titles or author names, mixed with fake names or titles (foils). The task for participants is to check off all of the titles or names that they recognize as real, with the foils used to correct for guessing. Checklist recognition tests are proxy measures of print exposure; the logic behind them is that, even if participants have not actually read a particular book title or author, those who recognize a relatively large number of authors or titles have more print exposure than those who recognize fewer authors or titles, because they spend more time reading, in bookstores, and so on. Current research supports these kinds of measures as indicators of participants' reading volume over time, with robust relationships to reading achievement in both children and adults (e.g., Spear-Swerling et al. 2010; Cipielewski & Stanovich, 1992; Cunningham & Stanovich, 1991, 1997; Mar & Rain, 2015; Martin-Chang & Gould, 2008; Mol & Bus, 2011; Sparks et al., 2014).

Beyond the measurement issues outlined above, different measures of print exposure may also tap somewhat different aspects of print exposure that vary in their relationships to achievement. For instance, frequency of reading and time spent reading, even if measured accurately without skewing from social desirability effects, are not the same as volume of reading over time. Two participants might spend the same number of minutes reading in a given week or report reading with the same frequency, such as almost every day, yet still have very different reading volume as determined by checklist recognition measures, because one participant reads faster than the other. Relative to checklist recognition tests, frequency of reading and time spent reading might also be more likely to vary situationally. High school and college students who are doing extensive reading for school or who couple part-time work with schooling might be disinclined to spend their limited free time reading, even if they generally like to read and can read well.

A recent study supports the idea that different measures of print exposure tap different aspects of print exposure, with varying relationships to achievement. Zhang et al. (2018) studied print exposure in kindergartners in China, using multiple measures such as parental reports of frequency of shared book reading, children's performance on a title recognition test with children's book titles, and a more direct measure requiring children to name the titles of books that they knew, as well as describe what the book was about. Multiple measures of print exposure predicted children's scores on a measure of breadth of vocabulary knowledge, but only the direct measure involving naming of book titles predicted scores on a measure of depth of vocabulary knowledge.

Genre also has emerged as an important consideration in investigations of print exposure. Stronger associations with verbal ability, general background knowledge, theory of mind, and social competence have been found for print exposure involving fiction books as compared to nonfiction book reading (Kozak & Martin-Chang, 2019). In line with these findings, one study (Spear-Swerling et al. 2010) showed that children with relatively weak reading comprehension had a preference for non-fiction books, whereas strong comprehenders scored higher on a measure of fiction book reading habits, as well as on an author recognition test involving children's

fiction. In multiple samples of university students, Mar and Rain (2015) found that exposure to narrative fiction had a stronger relationship to verbal ability as measured by a variety of tasks, including a subset of items from the SAT, than did exposure to expository nonfiction. These investigators speculate that structural and content differences between genres could account for these findings, such as the fact that narrative fiction is usually less lexically dense, with fewer technical words, than is expository nonfiction, which might make it easier to infer word meanings from context in fiction than nonfiction texts.

Still, other studies have found benefits for nonfiction print exposure. For example, Lawrence (2009) found that self-reported summer reading of expository nonfiction, as well as fiction, both predicted fall vocabulary scores in a group of adolescents from low socioeconomic backgrounds. A study of college students (Osana, Lacroix, Tucker, Idan, & Jabbour, 2007) found that a combined print exposure measure involving an ART that tapped general print exposure, and a second ART specifically tapping exposure to popular science authors, accounted for unique variance in syllogistic reasoning even after controlling for nonverbal cognitive ability and vocabulary knowledge.

The current study

The current study examined the print exposure of university students using a set of measures that varied in genre and task format, including newly developed author recognition tests for fiction and nonfiction, as well as open-ended questions about participants' favorite books and authors. We also employed a reading habits questionnaire with questions about magazine and newspaper as well as book reading, with some open-ended types of questions requiring naming of specific books, authors, magazines, and newspapers. Varied measures of print exposure were used to explore whether different measures assessed different aspects of print exposure, with potentially differing relationships to reading versus writing. Given the known relationships between print exposure and early success in learning to read, participants also were asked to provide retrospective self-ratings of their early reading experiences. The relationships between the different print exposure measures, self-ratings of early reading experiences, and participants' performance on several indicators of achievement, including SAT-Reading, SAT-Writing, and GPA, were then examined.

Our participants were all teacher education students, because the current study was done in the context of a broader research project motivated by recent state legislation. This legislation eliminated previously mandated basic skills testing in reading, writing, and mathematics for all prospective teachers. We had concerns about possible unintended consequences of the legislation, because the knowledge and skills required to teach literacy effectively to diverse populations of children are extensive (International Dyslexia Association [IDA], 2018; Moats, 1999), especially in the early grades when children must learn foundational literacy skills. For example, the understanding of English word structure needed for effective teaching of phonemic awareness, phonics, and spelling, is not intuitive even for highly literate adults (Brady et al., 2009; Cunningham, Perry, Stanovich, & Stanovich, 2004). In a

previous study (Spear-Swerling & Brucker, 2006), we found that teacher candidates with relatively weak component word reading and spelling skills had more difficulty acquiring knowledge about word structure in a course in which this knowledge was taught. Furthermore, we had concerns not only about prospective educators' essential academic skills, but also abilities and knowledge correlated with those skills—and in particular, print exposure.

To sum up, the main questions of the study were as follows: (1) How would participants perform on the print exposure measures? (2) Would different measures of print exposure tap distinct aspects of print exposure? (3) Which aspects of print exposure, including measures of fiction and nonfiction book reading, would relate most strongly to participants' achievement as measured by SAT-Reading, SAT-Writing, and GPA? (4) Which aspects of print exposure and achievement, if any, would relate to participants' self-ratings of their early reading experiences?

Method

Participants

The participants were 195 teacher-education students (44 male, 151 female; 114 undergraduate, 81 graduate; mean age = 25.11 years, $SD = 6.89$ years) from two different universities, University 1, a teaching-focused institution with many part-time students, including many who work while going to school ($n = 154$); and a major public research institution that is more selective in admissions and has a greater proportion of full-time students, University 2 ($n = 41$). All participants were fluent in English, but across both universities, about 15% of participants stated that they were also fluent in languages other than English, including Spanish, Portuguese, Chinese, Italian, and French; of these participants, over half said they spoke their other language almost every day.

At both institutions, participants were solicited from multiple education courses that were required of candidates in a range of School of Education programs, including courses on exceptional learners, teaching foundational literacy skills, teaching literacy in content areas, assessment of reading, and addressing literacy difficulties. Most participants came from programs involving special education ($n = 44$), elementary education or collaborative ($n = 48$), reading ($n = 27$), secondary math or science ($n = 20$), early childhood ($n = 18$), and secondary history ($n = 12$). Graduate and undergraduate participants were distributed across all of these programs, except for reading, which was a graduate program only. Eighty percent of participants were in initial certification programs, with the remainder in advanced (i.e., Masters) programs. All study participants were volunteers.

Materials and procedure

Participants took the measures of the study in groups in their classes, or in a separate appointment arranged with one of the investigators. Total administration time for the

measures was about 40 min. All measures were paper-and-pencil, beginning with a brief questionnaire containing questions about participants' demographic and educational backgrounds, including their age, gender, current program, and any teaching certifications they held. The questionnaire also asked participants to rate their early experiences in learning to read, using a question modeled after Applegate and Applegate (2004). This question defined "early reading experiences" as experiences learning to read in kindergarten through Grade 5, and participants were asked to indicate whether those experiences were mainly positive, mainly negative, or neutral (mixed). They were also asked to give a brief explanation of their ratings. After completing the questionnaire, participants took multiple measures of their print exposure.

Achievement measures

As part of informed consent procedures, prior to taking the print exposure measures participants were told that achievement information would be obtained from their university records, and that, as with other information from the study, these data would be kept completely confidential with their individual identities protected. All participants consented to these procedures. However, because some participants were transfer students and others were graduate students who had done their undergraduate work at other universities, the availability of achievement data varied. Out of the 195 participants who took the print exposure measures, undergraduate GPAs were available for 150; graduate GPAs for 68; SAT-Reading scores for 123; and SAT-Writing scores for 112. If more than one SAT score was shown in a participant's records, data analyses employed the average score. All participants had taken the version of the SAT administered prior to March 2016. SAT-Reading and SAT-Writing each include both fiction and nonfiction texts and tasks. Mean graduate GPAs were extremely high with limited variability (mean = 3.94, $SD = .14$), so the analyses reported here focus on undergraduate GPA.

Author recognition tests (ARTs) for fiction and nonfiction

Two separate but similarly constructed author recognition tests were developed, one with popular fiction book authors (ART-fic) and the other with popular nonfiction book authors (ART-nonfic). Classic authors of the type commonly read in school were not used, because, similar to original conceptualizations of checklist recognition measures of reading volume (see Stanovich, 2000), both ARTs were intended to measure voluntary reading, as opposed to required academic reading.

ART-fic had 40 popular fiction authors, half male and half female, interspersed with 32 fake names (again, half male and half female). Real fiction authors were selected via a web search of contemporary best-selling fiction authors on sites such as Amazon, Goodreads, the New York Times bestseller list, and best-selling lists of fiction authors on Wikipedia. Authors came from a range of fiction genres, including psychological/suspense thrillers, romance, dystopian fiction, and fantasy; they included Margaret Atwood, Diana Gabaldon, Neil Gaiman, John Grisham, and Jodi Picoult. Foils were randomly selected from the 1930 U.S. city directory for Fulton,

New York, obtained at Ancestry.com, with names checked online to ensure that none were fiction authors.

ART-nonfic had 40 popular nonfiction authors, half male and half female, selected similarly to the ART-fic measure, and with the same number of foils selected the same way as for the ART-fic. The ART-nonfic real authors came from a range of nonfiction genres including sports, adventure, politics, true crime, psychology, science, and memoir; these authors included Bill Bryson, Neil deGrasse Tyson, Jon Krakauer, Ann Rule, and Sheryl Sandburg.

For both ARTs, participants were instructed to check off all names that they were certain were real authors. They were cautioned not to guess because guessing could be detected by the foils. Analyses used a derived score calculated from the number of real authors correctly checked off minus the number of false alarms to foils. Thus, the highest possible derived score for each ART was 40. Cronbach's alpha for the ART-fic was .83 and for the ART-nonfic was .78.

Reading Habits Questionnaire (RHQ)

The Reading Habits Questionnaire comprised 14 questions focused on participants' current reading for enjoyment and/or for their own purposes (e.g., reading informational texts on how to grow a garden or improve one's athletic performance). Items on the RHQ were adapted from Spear-Swerling et al. (2010) and Guthrie et al. (1999), modified as appropriate for university students. Directions emphasized that required reading done as part of academic assignments or one's job should not be counted, as well as that an item read electronically (e.g., a book on a Kindle device or iPad, the online version of the *New York Times*) should be counted the same way as a print copy of these items. Table 2 lists the specific RHQ questions.

On RHQ items for which participants had to provide titles, all titles named were verified through online web searches as actual books, magazines, and newspapers. Online searches were also used to code each book named as a fiction or nonfiction book. To receive credit, participants had to provide a title that clearly referred to a specific, identifiable book, magazine, or newspaper. With only a couple of exceptions, all titles named by participants could be verified as real books, magazines, or newspapers, including many that were completely unfamiliar to the investigators. Raw scores for individual questions except for the two more qualitative items (Q8 and Q10) were summed to produce a total score. Cronbach's alpha for the RHQ was .80.

Favorites Questions (FQs)

Two open-ended questions, adapted from Spear-Swerling et al. (2010) and Stanovich and West (1989), asked participants to name, first, their favorite books and second, their favorite authors. Participants were encouraged to name as many favorites as they wished. Directions emphasized that favorite books and authors should involve books that participants had read in adulthood for enjoyment or their own purposes, not required reading for school or work. Similar to the RHQ items that required naming titles, all favorite book and author responses were verified via

web search. As on the RHQ, participants almost never named a title or author that could not be verified as an actual book or author.

After verification, titles and authors from the FQ were further coded as involving fiction or nonfiction. For authors who had written both fiction and nonfiction, a category was assigned based on the type of work the author wrote most often and for which he or she was best known. Cronbach's alpha for the FQs, across both fiction and nonfiction, was .73.

Results

Descriptive statistics

Table 1 displays descriptive data for participants from University 1 (the teaching-oriented university), University 2 (the research-oriented university), and the sample as a whole. A one-way analysis of variance showed that participants from University 2 were significantly younger than were those from University 1 $F(1, 193)=7.609$ ($p<.01$), as well as that they scored significantly higher on the SAT; for SAT-Reading, $F(1, 121)=55.488$, $p<.001$ and for SAT-Writing, $F(1, 110)=42.996$ ($p<.001$). These differences were expected based on the demographics of each institution. Chi square tests showed no significant differences between schools in gender composition, undergraduate/graduate composition, or participants' self-ratings of their K-5 reading experiences. About two-thirds of participants at each university rated their early reading experiences as mainly positive. Participants did not differ by school on any of the print exposure measures, except for one, total RHQ score, with

Table 1 Descriptive data by university and for total sample

Characteristic	University 1 <i>n</i> = 154 M (<i>SD</i>)	University 2 <i>n</i> = 41 M (<i>SD</i>)	Total <i>N</i> = 195 M (<i>SD</i>)	Range
Age in years	25.80 (7.27)**	22.51 (4.44)**	25.11 (6.89)	19–60
ART-fiction	4.30 (3.93)	4.85 (4.05)	4.42 (3.95)	–2 to 18
ART-nonfiction	2.31 (2.73)	2.71 (2.73)	2.39 (2.73)	–2 to 16
Number favorite books	2.24 (2.92)	2.37 (2.96)	2.27 (2.92)	0–17
Fiction	1.88 (2.69)	1.78 (2.48)	1.86 (2.62)	0–16
Nonfiction	0.37 (0.89)	0.59 (1.05)	0.41 (0.92)	0–6
Number favorite authors	1.20 (1.84)	1.29 (1.72)	1.22 (1.81)	0–11
Fiction	1.07 (1.64)	1.17 (1.66)	1.09 (1.61)	0–10
Nonfiction	0.12 (0.43)	0.12 (0.33)	0.12 (0.41)	0–3
Reading habits question- naire—total	9.14 (5.90)*	6.80 (3.85)*	8.65 (5.61)	0–30
Undergraduate GPA (<i>n</i> = 150)	3.44 (0.33)	3.45 (0.27)	3.45 (0.32)	2.00–4.00
SAT-Reading (<i>n</i> = 123)	470.69 (71.61)***	586.43 (74.45)***	497.04 (86.90)	260.00–710.00
SAT-Writing (<i>n</i> = 112)	476.55 (68.50)***	579.62 (75.83)***	500.47 (82.46)	310.00–730.00

* $p<.05$; ** $p<.01$; *** $p<.001$

participants at University 1 having higher scores than those at University 2, $F(1, 193) = 5.765, p < .05$.

Participants' performance on the print exposure measures

Author Recognition Tests (ARTs)

On both ARTs, false alarm rates to foils were very low (mean $< .3$), indicating that participants generally did not guess on these measures. As Table 1 shows, both measures had substantial and comparable ranges, with the highest score for ART-fic 18, and for ART-nonfic, 16. However, mean scores for both ARTs were far below the possible maximum score of 40. Paired-samples t-tests revealed that, on average, participants recognized significantly more authors on ART-fic than on ART-nonfic, $t = 8.583, df = 194, p < .001$. The most commonly recognized fiction authors were James Patterson (54% of participants), Stephanie Meyer (45%), Jodi Picoult (45%), John Green (44%), Danielle Steel (34%), and Nora Roberts (33%). The most commonly recognized nonfiction authors were Stephen Hawking (56%), Jane Goodall (48%), Neil deGrasse Tyson (30%), Rachel Maddow (16%), Oliver Sacks (9%), and Malcolm Gladwell (9%).

Favorites Questions (FQs)

On the open-ended questions asking participants to name favorite books and authors, performance again varied widely, but over one-third of participants (36%) had no favorite book, and nearly half (49%) had no favorite author. Other participants named as many as 17 favorite books and 11 favorite authors. Paired-samples t-tests indicated that participants named more favorite books on average than authors ($t = 6.902, df = 193, p < .001$). In addition, they named significantly more fiction than nonfiction books as favorites ($t = 7.670, df = 193, p < .001$), and significantly more fiction than nonfiction favorite authors ($t = 8.781, df = 193, p < .001$).

Reading Habits Questionnaire (RHQ)

Table 2 displays participants' responses to the RHQ items. The most frequent type of reading for enjoyment involved digital print media, with 75% of participants saying they read digital print media at least once per week or more. In contrast, only about 18% of participants reported reading books for enjoyment at least once per week or more, and percentages for frequency of magazine and newspaper reading (14% and 20% respectively) were comparably low. The most common reasons given for infrequent book reading were lack of time for pleasure reading (89% of participants) and a preference for non-reading activities such as sports, movies, or music (55%). (Percentages do not sum to 100 because participants could give more than one reason.)

Nonetheless, 41% of participants reported reading a fiction book within the past week or two, and 26% reading a nonfiction book, for enjoyment or their own

Table 2 Responses to the reading habits questionnaire for the total sample (N = 195)

Question	Responses and percentages of total sample
1. Have you done any reading in a fiction book for enjoyment or your own purposes in the past week or two? (This could be either the entire book, or part of a book)	Yes—40.5% No—59.5%
2. Have you done any reading in a nonfiction book for enjoyment or your own purposes in the past week or two? (Again, entire book, or part of a book)	Yes—26.2% No—73.8%
3. If you answered “yes” to either of the above questions (#1 or #2), name the title(s) of all book(s) in which you did some reading in the past one to 2 weeks	No titles named—50.8% 1 to 2 fiction—36.9% 3+ fiction—2.5% 1 to 2 nonfiction—22.6% 3+ nonfiction—1%
4. Have you done any reading in a magazine for enjoyment/your own purposes in the past week or two? (Entire magazine/part of a magazine.)	Yes—37.4% No—62.6%
5. Have you done any reading in a newspaper for enjoyment/your own purposes in the past week or two? (Entire newspaper/part of a newspaper)	Yes—34.4% No—65.6%
6. If you answered “yes” to either of the above questions (#4 or #5), name the title(s) of all magazines(s) and/or newspaper(s) in which you did some reading in the past one to 2 weeks	No titles named—52.3% 1 to 2 magazines—31.3% 3+ magazines—2.5% 1 to 2 newspapers—30.3% 3+ newspapers—2%
7. Have you read any <i>digital print media</i> in the past week or two (e.g., blogs, posts, web sites or other resources like Wikipedia, articles that were not part of an online newspaper, etc.)? Only count reading that you did either for enjoyment or your own purposes	Yes—72.8% No—27.2%
8. If you answered “yes” to the previous question, provide some examples of digital print media that you read in the past week or two	
9. About how often do you read a <i>book</i> (fiction or non-fiction), just for enjoyment/your own purposes?	Almost never—50.3% Once/twice a month—32.3% Once/twice a week—7.2% Almost every day—10.3%
10. If you answered “almost never” or “about once or twice a month” to the previous question, what are some reasons why you don’t read <i>books</i> more often?	Too busy—89.3% Prefer other reading materials to books—21.8% Prefer other activities to reading—55.0% Trouble finding books that interest me—22.5% Other—11.5%
11. About how often do you read a <i>magazine</i> , just for enjoyment/your own purposes?	Almost never—51.8% Once/twice a month—34.4% Once/twice a week—11.3% Almost every day—2.6%
12. About how often do you read a <i>newspaper</i> , just for enjoyment/your own purposes?	Almost never—58.5% Once/twice a month—22.1% Once/twice a week—12.8% Almost every day—6.7%

Table 2 (continued)

Question	Responses and percentages of total sample
13. About how often do you read <i>digital print media</i> , just for enjoyment/your own purposes?	Almost never—14.9% Once/twice a month—9.7% Once/twice a week—27.2% Almost every day—48.2%
14. About how often do you go to a bookstore and/or library, just for enjoyment or your own purposes, not for school or work?	Almost never—53.8% Once/twice a month—39.5% Once/twice a week—5.1% Almost every day—1.5%

purposes. Some participants read both genres, as shown by a significant positive relationship between the number of fiction and nonfiction books named in response to Q3 ($r=.20$, $p<.01$). In general, however, participants who were book readers were more oriented toward fiction than nonfiction voluntary reading.

Correlations of individual print exposure measures and achievement measures

To address the second and third questions of the study, we first examined correlations of the individual print exposure measures and the three achievement measures (undergraduate GPA, SAT-Reading, SAT-Writing). Table 3 displays these correlations, with age controlled.

Many of the print exposure measures correlated significantly and positively with each other, but the strongest relationships involved number of favorite fiction books and favorite fiction authors ($r=.67$, $p<.001$); scores on ART-fic and ART-nonfic ($r=.49$, $p<.001$); and number of favorite nonfiction books and nonfiction authors ($r=.43$, $p<.001$). ART-fic correlated more consistently with the other print exposure measures than did ART-nonfic. The strongest relationships between print exposure and achievement involved the two ARTs, which both had moderate

Table 3 Partial correlations between print exposure measures and achievement with age controlled

	1	2	3	4	5	6	7	8	9
1. ART-fiction	—								
2. ART-nonfiction	.49***	—							
3. Total RHQ	.37***	.18	—						
4. Fav auths-fic	.32**	.08	.30**	—					
5. Fav auths-nonfic	-.07	.17	.25*	.01	—				
6. Fav books-fic	.30**	.17	.17	.67***	-.02	—			
7. Fav books-nonfic	.22*	.23*	.29**	.12	.43***	.16	—		
8. SAT-Reading	.33**	.42***	.00	.16	.05	.20*	.15	—	
9. SAT-Writing	.43***	.45***	-.06	.19	.06	.29**	.21*	.80***	—
10. Undergrad GPA	.05	.11	-.09	-.24*	-.01	-.03	-.09	.25*	.33**

* $p<.05$; ** $p<.01$; *** $p<.001$

positive relationships to SAT-Reading and SAT-Writing, ranging from .33 to .45 (see Table 3). Total RHQ score did not correlate significantly with any of the three achievement measures. The only significant correlation between these measures of print exposure and undergraduate GPA involved number of favorite fiction authors, and this relationship was negative ($r = -.24, p < .05$).

We also calculated Spearman correlations between participants' retrospective self-ratings of their early reading experiences and the measures listed in Table 3. Participants' self-ratings correlated significantly and positively with both ARTs ($r = .21, p < .01$ for ART-fic, and $r = .16, p < .05$ for ART-nonfic), as well as with their SAT-Reading and SAT-Writing scores ($r = .41, p < .001$ for both SAT subtests). Early reading experience ratings did not correlate significantly with any other print exposure measure or with undergraduate GPA. Participants' explanations of their ratings typically referenced ease of learning to read; participants who rated their experiences as positive often noted that learning to read was easy for them, whereas those who gave mixed or negative ratings often noted difficulties in reading during these grades.

Exploratory factor analysis with print exposure measures

Exploratory factor analysis (EFA) was used to explore the underlying factor structure of the print exposure measures and help determine whether different measures of print exposure tapped different aspects of print exposure, the second question of the study. This analysis included several component scores from the total RHQ score, specifically, separate scores for participants' responses about current frequency of magazine reading, newspaper reading, reading of digital print media, and book reading, including fiction vs. nonfiction book reading. This approach yielded the following 14 variables which were employed in the factor analyses: ART-fic score, ART-nonfic score, number of fiction books read in the past week (Q3 on the RHQ), number of nonfiction books read in the past week (Q3 on the RHQ), frequency of book reading, frequency of magazine reading, frequency of newspaper reading, number of newspapers and magazines read in the past week (Q6 on the RHQ), frequency of reading digital print media, frequency of visiting bookstores/libraries for pleasure/own purposes, number of favorite fiction books, number of favorite nonfiction books, number of favorite fiction authors, and number of favorite nonfiction authors.

An initial principal components analysis suggested a four-factor solution for these data. The Scree test, Kaiser's eigenvalue greater than 1, and the underlying theory supported this solution. Following the identification of the four-factor solution, principal axis factoring (PAF) with direct oblimin rotation was used to estimate the underlying factor structure of the print exposure measures. The rotation method was used to account for the interrelationships between the factors, which were expected on theoretical grounds. For example, although university students may have a preference for one genre of reading over another, they are typically exposed to multiple genres. Total matrix sampling adequacy was middling (Kaiser–Meyer–Olkin

value = .756; Kaiser, 1974) and the presence of factor structure was indicated in Bartlett's test of sphericity (Chi square = 961.18, $df = 91$, $p < .001$) (Table 4).

The first factor, accounting for 26.9% of the variance, was composed primarily of ART-fic, favorite fiction books, and favorite fiction authors. Thus, this factor mainly involved fiction book reading volume, although ART-nonfic also had a substantial cross-loading (.309) on this first factor. The second factor (11.8% of the variance) was composed primarily of current frequency of newspaper reading, current frequency of magazine reading, number of newspapers and magazines read in the past week or two, and frequency of reading digital print media. This factor primarily involved current newspaper and magazine reading for enjoyment. Although reading of digital print media did not load heavily on any factor, its strongest association was with this second factor.

The third factor (7.3% of the variance) was comprised mainly of ART-nonfic, number of nonfiction books named as having been read in the past week, number of favorite nonfiction books, and number of favorite nonfiction authors. ART-fic also

Table 4 Pattern matrix from exploratory factor analysis with PAF

Print exposure measure	Factor 1 (fiction book reading vol- ume)	Factor 2 (current magazine and newspaper read- ing)	Factor 3 (nonfiction book reading volume)	Factor 4 (current book reading for enjoy- ment)
ART-fiction	.416	.053	.291	.039
ART-nonfiction	.309	.121	.465	-.089
Fav books-fiction	.658	-.025	-.046	.133
Fav authors-fiction	.806	.001	.096	.185
Library/bookstore- current frequency ^a	.083	.190	.026	.400
Book reading-current frequency ^a	-.028	.017	.168	.869
Number of books past week-fiction	.248	-.074	-.110	.648
Number of books past week-nonfic	-.146	.006	.634	.203
Fav books-nonfic	.072	-.005	.664	.010
Fav authors-nonfic	.017	.050	.672	-.077
Newspapers-current frequency ^a	-.134	.739	.043	.153
Magazines-current frequency ^a	.035	.741	-.053	-.015
Number of mags/news past week	.224	.865	-.041	-.107
Digital-current frequency ^a	-.070	.359	.037	.012

Emboldened numbers indicate the measures that loaded most heavily on a given factor

^aFrequency variables were calculated from individual questions on the RHQ involving current frequency of book, magazine, newspaper, or digital reading

had a substantial secondary loading (.291) on this factor. This third factor mainly involved nonfiction book reading volume. Finally, the fourth factor (5.4% of the variance) was composed primarily of current frequency of book reading for enjoyment, current frequency of going to bookstores/libraries for enjoyment/own purposes, and number of fiction books read in the past week or two. This factor involves measures tapping current book reading for enjoyment. The heaviest loading on this last factor of the variable involving number of fiction books read recently is consistent with the descriptive data from the RHQ, indicating that participants who were currently reading books were more oriented toward fiction than nonfiction reading.

To sum up the results of the EFA, the ARTs and the Favorites Questions tended to cluster on the same factors, whereas scores from the RHQ involving current frequency of reading loaded on separate factors. Genre of reading also played a role, with fiction book reading volume and nonfiction reading volume involving separate factors, although ones with substantial cross-loadings. Similarly, measures tapping magazine and newspaper reading loaded together on the same factor, largely separate from those involving book reading.

Relationships between the print exposure factors and achievement

Table 5 displays the correlations of the four factor scores from the PAF with each other, as well as with the three achievement variables involving undergraduate GPA, SAT-Reading, and SAT-Writing. Again, these were partial correlations with age controlled. There were several significant correlations among the factor scores, all positive. The strongest relationships with achievement involved fiction reading volume and nonfiction reading volume, which both correlated significantly with SAT-Reading, as well as with SAT-Writing; however, neither factor correlated significantly with undergraduate GPA. The only other significant relationship between any of the print exposure factors and achievement involved current book reading for enjoyment, which had a negative relationship with GPA ($r = -.23, p < .05$); that is, students who reported doing more book reading for pleasure had lower GPAs.

We also calculated relationships between participants' early reading experience ratings and the four factor scores, using Spearman correlations. Fiction reading volume and nonfiction reading volume maintained weak, but significant relationships

Table 5 Partial correlations of print exposure factors and achievement, controlling for age

	1	2	3	4	5	6	7
1. Fiction book reading volume	–						
2. Current magazine and newspaper reading	-.051	–					
3. Nonfiction book reading volume	.097	.38***	–				
4. Current book reading for enjoyment	.53***	.16	.30**	–			
5. SAT-Reading	.26*	-.07	.26*	.06	–		
6. SAT-Writing	.31**	-.09	.28**	.07	.80***	–	
7. Undergrad GPA	-.15	-.02	.007	-.23*	.28**	.33**	–

* $p < .05$; ** $p < .01$; *** $p < .001$

with the early reading experience ratings ($r = .15$, $p < .05$ for both factors). Neither of the other two factors related significantly to participants' self-ratings of their early reading experiences.

Group differences based on early reading experience self-ratings

To further examine relationships between participants' self-ratings of their K-5 reading experiences, print exposure, and achievement, we compared the print exposure and achievement of groups based on the self-ratings. About two-thirds of participants rated themselves as having early reading experiences that were mainly positive (Group 1, $n = 129$); therefore, for these comparisons the mixed experience group ($n = 48$) and the mainly negative group ($n = 17$) were combined into one group, Group 2 ($n = 65$). Chi square tests indicated that Groups 1 and 2 did not differ by school, graduate/undergraduate status, or gender, although results for gender approached significance ($p = .056$), with more males in Group 2.

For this analysis, in addition to SAT achievement and undergraduate GPA, we examined a subset of the participants' performance in a specific course offered at University 1, a reading methods course taught by a variety of instructors which is focused on content about structure of language and explicit, systematic teaching of foundational reading skills (see Spear-Swerling & Brucker, 2004, 2006). Course content and expectations for this course are very consistent with the *Knowledge and Practice Standards for Teachers of Reading, Second Edition* (KPS; IDA, 2018), especially in relation to the standards involving typical development in reading, common reading difficulties, and Structured Literacy approaches to teaching phonemic awareness, phonics, fluency, and spelling. Not all participants had taken this course, which was a requirement only for special education and collaborative elementary/special education candidates at University 1; other education and reading methods courses taken by participants did not generally involve a focus on this kind of content. Despite the lack of a relationship between the self-ratings and overall GPA, we thought that there could be some linkages between the self-ratings and performance in the KPS-related course, because of findings from a previous study (Spear-Swerling & Brucker, 2006) that teacher candidates with relatively weaker component word reading and spelling skills had more difficulty with course content involving word structure and phonics. Final grades for the course were on the transcripts of 45 participants, 32 of whom were in the positive reading experience group and 13 of whom were in the mixed/negative group. Letter grades were coded as 0 for an F, 1 for a D-minus, 2 for a D, and so on, up to 12 for an A-plus.

Table 6 displays results of these comparisons. Regarding the individual print exposure measures, Mann–Whitney U Tests showed that Groups 1 and 2 differed significantly only on the ARTs, with Group 1 outperforming Group 2, and with larger differences for ART-fic than ART-nonfic. Regarding achievement, there were large, significant differences on both SAT-Reading and SAT-Writing, but no significant differences in overall GPA. However, there were small, but significant differences in the grade for the KPS-related course at University 1, favoring Group 1, the group with positive early reading experiences.

Table 6 Performance of early reading experience groups in print exposure and achievement

Characteristic	Group 1 (Positive early reading experience) <i>n</i> = 129 <i>M</i> (<i>SD</i>)	Group 2 (Mixed/negative early reading experience) <i>n</i> = 65 <i>M</i> (<i>SD</i>)
Age in years	25.00 (7.33)	25.43 (6.05)
ART-fiction	4.88 (3.91)**	3.55 (3.91)**
ART-nonfiction	2.62 (2.79)*	1.97 (2.57)*
Number favorite books	2.50 (3.25)	1.84 (2.06)
Number favorite authors	1.36 (1.94)	.97 (1.52)
Reading habits questionnaire—total	8.90 (5.68)	8.22 (5.50)
Undergraduate GPA (<i>n</i> = 150)	3.46 (.33)	3.41 (.29)
SAT-Reading (<i>n</i> = 123)	518.17 (81.42)***	447.92 (79.95)***
SAT-Writing (<i>n</i> = 112)	520.35 (80.21)***	454.88 (69.16)***
Course grade—structure of language/reading methods (<i>n</i> = 45)	10.63 (1.58)*	9.62 (1.71)*

p* < .05; *p* < .01; ****p* < .001

Discussion

Answers to the study questions

Regarding the first question of the study—participants' performance on the print exposure measures—several patterns emerged. First, despite the fact that the participants were university students with relatively high overall achievement, the print exposure measures all showed substantial variability. Results of the Reading Habits Questionnaire were consistent with other studies (Huang et al., 2014; Mokhtari et al., 2009) in showing that the most popular type of pleasure reading for these teacher-education students involved digital print media, such as web sites, online articles, and social media. About 75% of participants reported regular voluntary reading of digital print media, at least once a week or more, whereas only about 18% of participants reported regular book reading of at least once per week for enjoyment or their own purposes. Magazines and newspapers, including digital versions of these texts, also were not read frequently by these participants. Participants overwhelmingly attributed lack of book reading for enjoyment to limited time, with over half also mentioning a preference for non-reading activities such as sports. Those reporting pleasure reading of books were more oriented toward fiction than nonfiction, and performance on the ARTs and Favorites Questions agreed with the RHQ in suggesting relatively greater fiction than nonfiction print exposure. Nevertheless, some participants seemed to have quite low levels of print exposure for both fiction and nonfiction book reading.

Several of the individual print exposure measures correlated significantly, and positively, with each other. However, with regard to the second question of the

study, exploratory factor analysis suggested that different measures of print exposure did tap somewhat different aspects of print exposure. Four factors emerged from the EFA. Measures that tapped *current frequency* of reading, such as scores from the RHQ about how many books participants had read in the past week, loaded separately from measures believed to tap *reading volume over time*, such as the Author Recognition Tests. The Favorites Questions loaded with the two ARTs, indicating that these questions might also tap reading volume over time to some extent. In addition, different genres of reading—specifically, fiction book reading, nonfiction book reading, and magazine/newspaper reading—loaded mostly on separate factors, supporting the relevance of genre to investigations of print exposure.

Regarding the third question of the study, relationships between different aspects of print exposure and achievement, with age controlled, only the factors involving fiction and nonfiction book reading volume had positive relationships to SAT achievement. These relationships were significant for SAT-Writing as well as SAT-Reading. The factor involving current book reading for enjoyment had a *negative* relationship to GPA, a result that initially seems puzzling. However, this pattern of relationships may reflect the nature of the achievement measure as well as the aspect of print exposure being assessed.

Specifically, when the achievement measure involved a standardized test of literacy, the SAT, and when print exposure measures tapped reading volume over time (i.e., the two ARTs as well as the fiction and nonfiction book reading volume factors from the EFA), relationships were consistently significant and positive. Conversely, GPA is influenced not only by literacy abilities, but also by other abilities and dispositions such as motivation and task persistence. Furthermore, although grades are quantitative, they are somewhat more subjective than SAT scores. Even for the same level of performance, grades might differ substantially from one course instructor to another depending on factors such as the instructor's expectations, rigor in grading, weighting of student effort in determining grades, and so on. Also, in contrast to the fiction and nonfiction book reading volume factors, the factor involving current book reading for enjoyment tapped frequency of reading at the moment, not volume of reading over time. Frequent pleasure reading may therefore have reflected less attention to pursuits contributing more directly to GPA, such as course reading and school work, which may explain the negative relationship between this factor and GPA.

Reading of digital print media, while popular among these participants, did not load heavily on any of the print exposure factors, and did not correlate significantly with SAT performance. Recent meta-analyses (Clinton, 2019; Delgado et al., 2018) suggest a small benefit to reading print over digital sources when it comes to comprehension and learning from print. Singer and Alexander (2017) have suggested that the benefit of print might be related to a disruptive effect of scrolling, and the increase in reading rate readers report when reading digital sources. Furthermore, in the current study, reading of digital print media generally involved relatively short texts such as online articles and social media posts; the content and structure of these texts tends to differ from that of most books. These length, content, and structural variables also may help explain the lack of a relationship between reading of digital print media and SAT performance.

Of the individual print exposure measures in this study, and in line with other studies, results favored both ARTs as the best indicators of long-term print exposure. The two ARTs had stronger relationships to SAT-Reading and SAT-Writing than any other print exposure measure. Also, of the individual measures, only the two ARTs correlated significantly with participants' self-ratings of their early reading experiences. While not as accurate as early reading assessment data, which were not available to us, these relationships of the self-ratings with the ARTs as well as with SAT achievement are nevertheless consistent with longitudinal studies showing that early reading achievement predicts long-term print exposure as well as long-term reading achievement (Cunningham & Stanovich, 1997; Sparks et al., 2014). The comparison of groups based on early reading experience self-ratings was also consistent with these findings. Furthermore, this last comparison demonstrated that, although participants with positive early reading experience ratings did not differ from those with mixed or negative ratings in *overall* GPA, the former did outperform the latter in a specific reading methods course that involved learning how to teach foundational reading skills.

Similar to other studies (Mar & Rain, 2015; Martin-Chang & Gould, 2008), this study supports the relevance of fiction book reading to literacy achievement in young adults. Moreover, fiction book reading may have other positive impacts as well, such as on empathy and perspective-taking (Kozak & Martin-Chang, 2019; Wolf, 2018). However, the positive results we obtained for nonfiction print exposure differ from those of some other investigators, such as Mar and Rain (2015), who found weak or nonsignificant relationships between a nonfiction scale of their ART and a variety of verbal tasks, including a subset of items from the SAT. These different findings may relate to methodological differences between the two studies. For example, Mar and Rain (2015) focused on authors of expository nonfiction, whereas our ART-nonfic measure included not only authors of expository nonfiction, but also authors of narrative nonfiction such as memoir.

A previous study (Spear-Swerling et al. 2010) involving children and some similar measures of print exposure to those employed here found that, like the university students in the current study, avid readers tended to be readers of fiction books. Similar to the current study, an author recognition test involving fiction had significantly stronger relationships to achievement than did a reading habits questionnaire. However, the current study did not duplicate the findings of Spear-Swerling et al. (2010) that weaker readers had a preference for nonfiction, perhaps because the participants in the current study were older and functioning at much higher literacy levels overall.

Limitations

Important limitations of this study include the fact that SAT and undergraduate GPA data were not available for all participants who took the print exposure measures. Also, no reading or writing achievement measures were administered as part of the study; rather, all achievement data—SAT scores and undergraduate GPAs—were gathered from participants' academic records. A thorough examination of writing

in particular would have entailed more in-depth assessment than was feasible in the context of this study. Nevertheless, despite these limitations, we found significant patterns of relationships between prior SAT achievement and later performance on print exposure measures, patterns consistent with the idea of a bidirectional relationship between print exposure and achievement (e.g., Mol & Bus, 2011).

Several of our print exposure measures, especially those involving frequency of reading, could have been influenced by social desirability effects. Still, many participants gave “socially undesirable” responses, admitting that they almost never read a book, newspaper, or magazine for enjoyment. In addition, we cannot know whether participants who claimed to be reading specific texts were actually doing so. However, it was very rare for a participant to name a book, magazine, or newspaper on the RHQ that was not real, including many titles that were unknown to the investigators before verifying them.

Implications

This study provides evidence of the relationship between writing achievement and reading volume, a less widely studied relationship than the one between reading achievement and reading volume. In addition, the current study demonstrates significant relationships between achievement and nonfiction book reading, as well as fiction book reading. This finding suggests that further exploration of the role of nonfiction print exposure in achievement, such as along the lines of Osana et al. (2007), is warranted. For instance, future research could explore the extent to which exposure to different kinds of nonfiction, such as narrative versus expository nonfiction, relates to varied measures of achievement, in writing as well as reading.

Our findings also provide further support for the views of researchers (e.g., Applegate & Applegate, 2004; Nathanson et al., 2008) who have expressed concerns about high levels of “aliteracy” in teacher candidates. In this study, many teacher candidates evidenced low levels of print exposure. Given the importance of teachers’ ability to serve as good models of literacy for their students (Snow, Griffin, & Burns, 2005), and the fact that teachers’ own reading experience may influence their planning for instruction (Kozak & Martin-Chang, 2019), these findings are unsettling. Furthermore, low SAT achievement and limited print exposure were significantly associated with each other. Many types of expertise, knowledge, and dispositions contribute to successful teaching, and some teacher candidates in this study who appeared to have low levels of print exposure might still become capable teachers. Nevertheless, these results suggest that policymakers who plan to eliminate essential skills testing for teacher candidates should be wary of unintended consequences, not only those involving candidates’ essential academic skills, but also valuable dispositions and knowledge correlated with those skills, including print exposure.

Finally, there is an important nuance to our findings. The current study suggests that the individual candidates who should spark concerns may differ depending on the print exposure measure. Candidates who reported infrequent book reading for enjoyment on a questionnaire about their current reading habits were not the necessarily the ones who should raise the greatest concerns for teacher educators; in fact,

these candidates tended to have higher GPAs than did candidates who reported very frequent pleasure reading, perhaps because the former were more focused on their schooling. Rather, the study suggests that candidates who demonstrated the lowest levels of print exposure on the indicators of reading volume over time, such as on the ARTs, should raise the greatest concerns. In addition to limitations in print exposure, these latter candidates were more likely to have lower literacy achievement than other candidates, as well as to report less positive early reading experiences. Moreover, candidates who reported less positive early reading experiences had lower performance in a specific course involving teaching of foundational reading skills. Thus, as Zhang et al. (2018) point out, how print exposure is measured has not only theoretical implications, but practical ones as well.

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