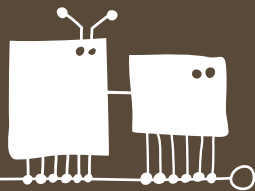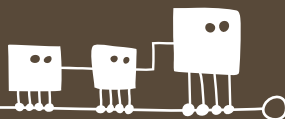# Getting a read on the app stores

A market scan and analysis of children's literacy apps

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About the authors

Sarah Vaala is Senior Fellow at the Joan Ganz Cooney Center and a Research Associate at the Vanderbilt University School of Nursing. She is interested in the diverse educational and health implications of media in the lives of children, adolescents, and their families, as well as the way parents and educators make decisions about children's media use. After completing her PhD in Communication at the Annenberg School for Communication in 2011, she joined the Cooney Center as the 2011–2012 Research Fellow, where she studied families' use and perceptions of co-reading e-books on mobile devices, and helped to organize a convening of researchers, industry figures, educators, and policymakers interested in Latino families' use of digital media for learning. Vaala's work at Vanderbilt involves designing and testing media tools to boost problem-solving skills and medical adherence among adolescents with chronic illness.

Anna Ly is Senior Manager of Creative Technology Partnerships at Sesame Workshop, the non-profit organization behind the beloved show, *Sesame Street*. She develops and designs new ways of storytelling, interacting, and playing together through technology. She is responsible for partnership strategy to build out and deliver those experiences to help make kids smarter, stronger, and kinder. Formerly part of the Content Innovation Lab at Sesame, where she focused on emerging technologies, and at the Joan Ganz Cooney Center, where she was responsible for strategic planning and publications, Ly has also been a fellow at both the Fred Rogers Center and the Joan Ganz Cooney Center. She studied Human-Computer Interaction, Finance and Communication Design at Carnegie Mellon and graduated from the Learning, Design & Technology Masters program at Stanford University, where she focused on interaction and information design, as well as children with learning disabilities.

Michael H. Levine is the founding executive director of the Joan Ganz Cooney Center at Sesame Workshop. Prior to joining the Center, Levine was Vice President for Asia Society, managing interactive media and educational initiatives to promote knowledge and understanding of other world regions and cultures. Michael previously oversaw Carnegie Corporation of New York's groundbreaking work in early childhood development and educational media, and was a senior advisor to the New York City Schools Chancellor, where he directed dropout prevention and afterschool programs. He writes for professional and public affairs journals, including a regular column for *Huffington Post* and is a frequent keynote speaker at education and technology conferences around the world. His new book, co-authored with Lisa Guernsey, *Tap, Click, Read: Growing Readers in a World of Screens* was published in September 2015.

A PDF of this report is available as a free download from: www.joanganzcooneycenter.org.

contents

executive summary

In previous research the Joan Ganz Cooney Center and New America have characterized the children's educational app market as a "Digital Wild West" (Guernsey, Levine, Chiong & Severns, 2012; Shuler, 2011). The marketplace is chock full of choices but lacks essential information to aid parents' and educators' decision-making. In 2014, the Joan Ganz Cooney Center, with partners at New America, launched a new study of the most popular educational apps marketplace by focusing an in-depth inquiry on literacy-focused apps for children ages 0-8 years. We analyzed a sample of 183 apps from among lists of the "Top 50" educational apps in popular app stores and those that had recently won critical acclaim from expert review sites. Next, we examined the apps along numerous dimensions, including characteristics of their descriptions (e.g., number of words used to describe each app; target audience age-range; specific skills mentioned) and features within their actual content (e.g., the nature of adult-directed information; types of activities). Below are the study's key findings.

Key findings regarding app descriptions

Language- and literacy-focused apps for young children comprise a substantial share of popular and promoted apps marketed as "educational"
34% of all "Top 50" apps that were paid and 29% of all "Top 50" apps that were free were added to our sample as language- and literacy-focused apps for young children. When looking at expert review sites (Common Sense Media; Parents' Choice Awards; and Children's Technology Review), we found that 21% of Expert-awarded apps fit these criteria.

Parents are likely to encounter different apps depending on where they look
In our sample, only 17% of apps were simultaneously listed among the "Top 50 educational" apps in an app store and among the Expert-awarded apps (from 2013-2014). There may be some further cross-over with time, as top apps from app stores win awards later or awarded apps become promoted in top 50 lists. However, these findings indicate that two parents who search for children's apps at the same time via different sites will encounter largely different apps. What is more, the Expert-awarded apps tend to cost $1-$2 more than top 50 paid apps, possibly perpetuating an "app gap" whereby more affluent families will end up with higher quality apps.

Children's language- and literacy-focused apps range considerably in the amount of information provided to parents in app store descriptions
The number of words in our sample apps' descriptions varied considerably, from 13 to 1,089 words, suggesting that parents and educators could learn a lot about one app and very little about another before deciding whether or not to purchase them. The average length of these descriptions varied such that those listed among the Top 50 Paid educational apps tended to have longer descriptions (Average = 369 words), compared to Top 50 Free educational apps (Average = 293 words). The description length of Expert-awarded apps fell in the middle (Average = 342 words).

Apps for the preschool-age audience are especially plentiful
Despite the substantial difference in the language and literacy skills appropriate for children across the 0 to 8 year age-span, we found that approximately 40% of app descriptions give little or no indication of the specific age or developmental stage appropriate for the respective apps. When target age ranges were listed, most apps (90%) listed preschool-age children as at least part of the target audience. An examination of the specific language and literacy skills mentioned in app descriptions also indicated a predominant focus on the preschool and kindergarten audience: the most commonly encountered skills included proficiencies like alphabet knowledge, phonemic awareness, and understanding upper vs. lowercase letters.

Most apps do not mention various "benchmarks" of educational quality, including education or child development expertise on the development team, underlying curricula, or research testing
Less than half of the apps in our sample provide information about their development teams. The percent of apps that mentioned a child development, education, or literacy expert involved in app development ranged from 36% of Top 50 Paid apps to 20% and 18% of Top 50 Free and Expert-awarded apps, respectively. Fewer than a third of all apps mentioned an underlying educational curriculum (29%). Any kind of app testing was even more rare: 24% of app descriptions mentioned research testing, which was overwhelmingly usability or appeal testing rather than learning efficacy.

Key findings regarding app content

Most language- and literacy-focused apps for children feature competitive or testing-based activities such as games, puzzles, and quizzes
The majority of the apps in our sample (71%) contained at least one activity that we classified as a puzzle, game, or quiz. These were activities which had right and wrong answers, rather than open-ended designs. The percentages of apps containing puzzles, games, or quizzes did not vary based on whether apps had won awards from expert review sites or were listed among the Top 50 Paid or Free apps in educational sections of app stores. However, apps that had won awards from expert review sites were more likely than other apps to contain storybooks or other narrative formats (56%, compared to 39% of Top 50 Paid and 29% of Top 50 Free).

Hotspots, which make noise or animate when touched, and narration are common in children's language- and literacy-focused apps
Nearly all of the apps in our sample (92%) contained some form of animation. In 45% of apps we also found interactive "hotspots," or sections of the screen that move and/or make noise when touched in ways that are not central to the game or story.

In keeping with the focus on the preschool and kindergarten age group, 34% of the apps read storybooks aloud while 89% narrated other types of activities within the app.

The majority of language- and literacy-focused apps provide some in-app information to parents, but the nature of that information varies
We found that most of the apps (79%) contained some adult-directed information within the app's content. Overwhelmingly, this adult-directed information was contained in a specific section of the app (e.g., "Parent section"; 76% of apps). The type of information provided to adults varied considerably. Many apps gave basic instructions on how to use the app (40%), while others gave adults information about privacy and security (38%). Few offered feedback to adults about children's performance (17%), gave suggestions for enriching the app's use or effectiveness (17%), or offered more detail about the educational content (14%). Notably, detailed information about the educational content, such as what the app's teaching strategies entailed or why certain skills were important, were most commonly encountered in Expert-awarded apps (27%) compared to Top 50 Paid (9%) or Top 50 Free apps (10%).

Many apps allow users to adjust some structural settings related to educational content, though very few have broad content "leveling" options
We looked at various forms of customization options within each app and found that the ability to adjust basic settings (such as turning the music off and on) was quite common (66% of apps). Many apps also enabled users to adjust structural aspects of the educational content (such as the number of response options offered in a quiz; 51%). What was considerably more rare was the ability to set the overall level of difficulty for a user (also known as "leveling"; 17%). Leveling was somewhat more frequent in Top 50 Free apps (29%), compared to Top 50 Paid (13%) or Expert-awarded apps (14%).

Few popular language- and literacy-focused apps are explicitly designed to promote joint media engagement
Given the proven benefits of intergenerational and joint peer engagement around digital media, we looked for various explicit functions within the apps that would allow children to share content or connect socially through the app, or to co-use it with others. Very few apps in this sample had any of these joint media engagement features. In fact, only two apps had explicit co-use functions built into their design, such as collaborative or competitive play with another player. Fewer than 10% allowed users to contact or share content with others, through social networks, email or text, or directly through the app.

Recommendations for industry, parent/educator, and research communities

Opportunities for industry:

Develop industry-wide standards for the education category
A set of specific criteria for guiding an app's placement into the "educational" category could guide developers' classification of their apps and help assure consumers that they have educational value. Similarly, a uniform or easily comparable way of delivering information within and across app stores could help parents and educators compare apps and make informed decisions.

Provide consumers fully transparent information about content and ranking processes
Parents and educators looking for children's educational apps would benefit from more detailed information about the apps' content and development and how apps end up on the "Top Educational" lists. At the time of this analysis, none of the app stores posted information about how their rankings are devised.

Design for intergenerational use (joint media engagement)
Young children learn best when another caring individual joins in the process. Educational app developers should consider explicit design features that engage multiple users. Specific suggestions include designing with the child user's interests in mind, incorporating content or mechanics that are more challenging to maintain an older user's interest, and enabling co-users to create content together.

Suggestions for parents and educators:

Search for information about apps through different sources
Given the inconsistency in information posted about apps and the nature of apps promoted through different sites, parents and educators need to do some extra legwork to identify quality language- and literacy-focused apps. Try looking for information about apps of interest across app stores and expert review sites, and looking at producers' websites.

Give voice to frustrations and great finds
Parents and educators should consider giving feedback—positive and negative—to developers in order to impact change or reinforce desired app features.

Guidance for researchers:

Investigate the characteristics of language- and literacy-focused apps that are most effective for teaching young children
Researchers are now focused on the apps marketplace and its potential. They should continue to conduct empirical studies of the design, content, and use factors that optimize the educational value of children's apps, particularly with regards to language and literacy learning.

Translate and share findings with developers as well as parents and educators
Researchers who work in this field should make a concerted effort to translate their findings into accessible and actionable recommendations, and share their guidance with parent, educator, and industry audiences.

introduction

In a knowledge-based, global economy, knowing how to read well is more important than ever, and yet a large majority of the coming generation—two-thirds of America's children—are leaving elementary and middle school with distressingly weak reading skills.

The startling data from the Annie E. Casey Foundation's report (2010) on America's lack of progress in early literacy development over the past 15 years reveal a "quiet crisis" (Guernsey & Levine, 2015). Despite billions of dollars of public investment and major advances in the scientific evidence on effective early literacy instruction, our national reading strategy is stuck in a rut.

Through the work of state and national leaders, communities and school districts across the United States have recently pledged to get serious about closing these deficits and finding new solutions. Their work has been spurred in part by the Campaign for Grade-Level Reading, a collaborative effort by foundations, nonprofit partners, states, and more than 140 communities to ensure that all children succeed in school and graduate prepared for college, a career, and active citizenship.

In 2012, the Campaign asked the Joan Ganz Cooney Center and New America to conduct a nationwide scan of technology-based products and technology-assisted programs aimed at improving the early literacy skills of children from birth through age eight. Our task was not to evaluate the effectiveness of products and programs but to act as surveyors of uncharted lands, returning with community-oriented guidance and a high-level view of what is currently made available to parents, educators, and children. An important section of that report concluded that the burgeoning apps marketplace had the features of a non-transparent and difficult to navigate new neighborhood which we referred to as the "Digital Wild West" (Guernsey, Levine, Chiong, & Severns, 2012). That report found that the marketplace was lagging in meeting the needs of today's young readers. There was a serious mismatch in what the preponderance of apps developers were producing—focused largely on basic skills such as phonemic awareness and decoding—and what children need—deeper literacy learning, including complex vocabulary and comprehension. In simple terms, the apps marketplace was filled with a preponderance of literacy products, but few were meeting the very important requirement that children be exposed to both skills and deeper knowledge-building experiences for literacy in our modern age.

In 2014, we conducted a follow-up analysis of the apps marketplace with support from the Campaign and the Pritzker Children's Initiative. This report delves into our findings and helps frame a broader analysis of what might be done to help the adults in children's lives effectively pioneer the Digital Wild West.

Using research-informed principles for examining the role of technology in early literacy, we kept our eyes open for important gaps, probing for what is available and what may be missing in current uses of technology by children, parents, and educators.

Cascading effects: The Potential of connected parents and educators engaged with children (0–8) around quality media

Infants and toddlers in "serve and return" conversations with engaged parents and caregivers

"Blooming" in language development, acquiring background knowledge and learning how the world works

Young children at ease learning early literacy skills and using knowledge to comprehend printed and digital texts

By third grade: Proficient readers, confident learners, empowered to reach their full potential

From *Pioneering literacy in the digital wild west: Empowering parents and educators*, L.Guernsey, M. Levine, C. Chiong, & M. Severns, 2012. New York: The Joan Ganz Cooney Center at Sesame Workshop.

We came to this research with a grounding in developmental science on how infants, toddlers, and preschoolers learn language skills and with an understanding of how those language skills set a foundation for reading proficiency in the early grades of elementary school. Just as research has highlighted the power of dialogic questioning and engaging conversation between adults and children during read-alouds of print books, research on electronic media with young children—even infants and toddlers—points to the benefits of parents or teachers engaging in social interactions around other media too.

Technology is omnipresent in the lives of most young children today, and new platforms and content are arriving all the time. Television, mobile games, YouTube clips, digital cameras, Skype, and FaceTime—each of these technologies, and more, are making their way into the households and daily routines of families with young children.

Around a quarter of young children now have their own gaming devices, according to *Zero to Eight*, a 2011 Common Sense Media report on young children and media. In that report, an analysis of survey data on 6-month to 6-year-old children showed a jump in the quantity of time spent with screen media. The number of minutes per day rose from 1 hour and 36 minutes in 2005 to 2 hours and 8 minutes in 2011, with time on tablets and computers making up a significant chunk of the difference.

It is not surprising, then, that the market for children's apps, e-books and digital games is booming. In a previous examination of Apple's App Store (Shuler, 2012), the Joan Ganz Cooney Center found that more than 80% of top-selling paid apps in the Education category target children. Of those, 72% target preschool-aged children. Of interest to our teams at the Cooney Center and New America is whether the blizzard of apps labeled educational and literacy-oriented might make a meaningful difference in helping children, especially those from underserved communities, learn to read well. And to understand that possibility, we have also been examining whether the marketplace is providing a fair shot to families across income and ethno-cultural backgrounds.

Digital equity

The conventional understanding of the digital divide has been centered on access. Do disadvantaged families have computers? Are they up to date? Can they afford broadband Internet access, not to mention new hardware and software? Research suggests that the conventional divide still exists, though historical data on families with young children are hard to come by. More than 30% of households of all kinds still do not have computers with access to broadband Internet (Pew, 2012). A new Common Sense Media report (2015) indicates that youth ages 8–18 from lower-income households are less likely to live in homes enriched with access to digital technologies. For example, the study found that 10% of teens from lower-income families had only dial-up internet at home, and only 51% had their own smartphones. Conversely, none of the upper-income teens surveyed had dial-up Internet, and 78% owned smartphones.

Numerous experts (see Neuman & Celano, 2011, Katz & Levine, 2015, Jenkins, 2007) have documented that many families are now experiencing a "participation gap," in which their lack of expertise in using digital technologies may be an even more important challenge to digital equity. A forthcoming study from the Joan Ganz Cooney Center (Rideout, in press) will show that low-income families still significantly lag behind their peers in consistent access to the Internet as well as in the number and types of devices they have available for important educational activities such as homework. In addition, the access divide may be turning into an "app gap," a term coined in Common Sense Media's (2011) *Zero to Eight* report. It showed that children from low-income households use apps and mobile devices less frequently than children from high-income households. Other data from the Cooney Center's research (see Katz & Levine, 2015, Lee & Baron, 2015, Rideout, 2014) indicate that Hispanic-Latino families especially are experiencing a gap in the amount and types of digital products that are culturally and linguistically appropriate to meet their children's educational needs.

These equity concerns are paramount, of course, if we wish to address the "quiet crisis" of our national reading performance. With so much of our children's future riding on the ability to learn to read, schools and community leaders have a responsibility to assess how technology fits into the lives of the children they are trying to help—and how it might be used to further, not stymie, their language and literacy development.
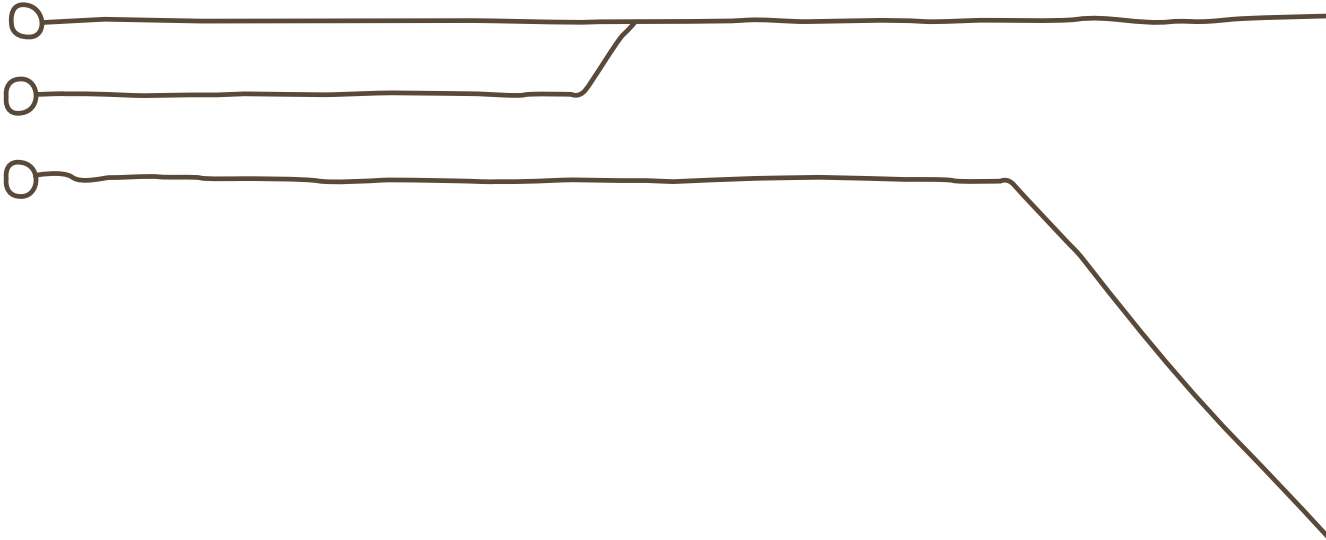
methods

We conducted a scan of the market for young children's language- and literacy-focused educational apps, and analyzed their descriptions (in app stores and on producers' websites) and content. Our investigation was limited to interactive apps.

We collected the Top 50 Paid and Top 50 Free apps listed in the education sections of three stores—Apple App Store, Google Play, and Amazon Appstore—over eight weeks in February and March of 2014. From the 2,400 titles identified through this scan (50 apps per store across three stores per week across eight weeks for both paid and free apps) we identified those apps which were (1) intended for children birth through age 8, and (2) focused at least in part on teaching language and literacy skills (based on their descriptions). Next, we obtained lists of highly rated or awarded apps from Common Sense Media, Parents' Choice Awards, and Children's Technology Review (in this report we refer to those that were highly rated or awarded by expert review sites either as "Expert-awarded" or "Awarded" apps (see sidebar on p. 15). From these three lists, we identified apps targeting language and literacy skills (per their description) for children birth through 8, yielding a total of 183 apps.
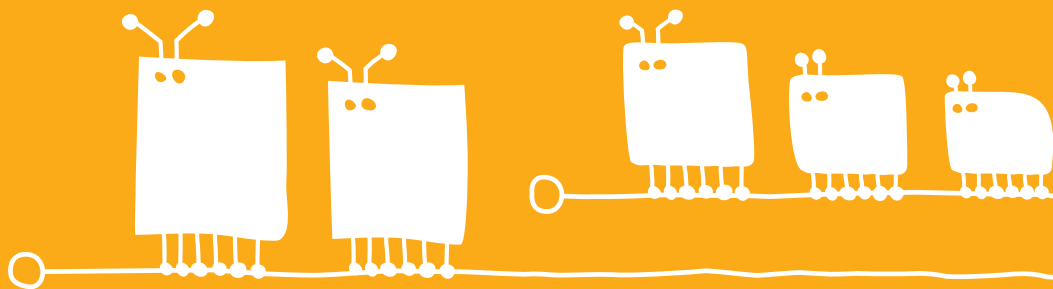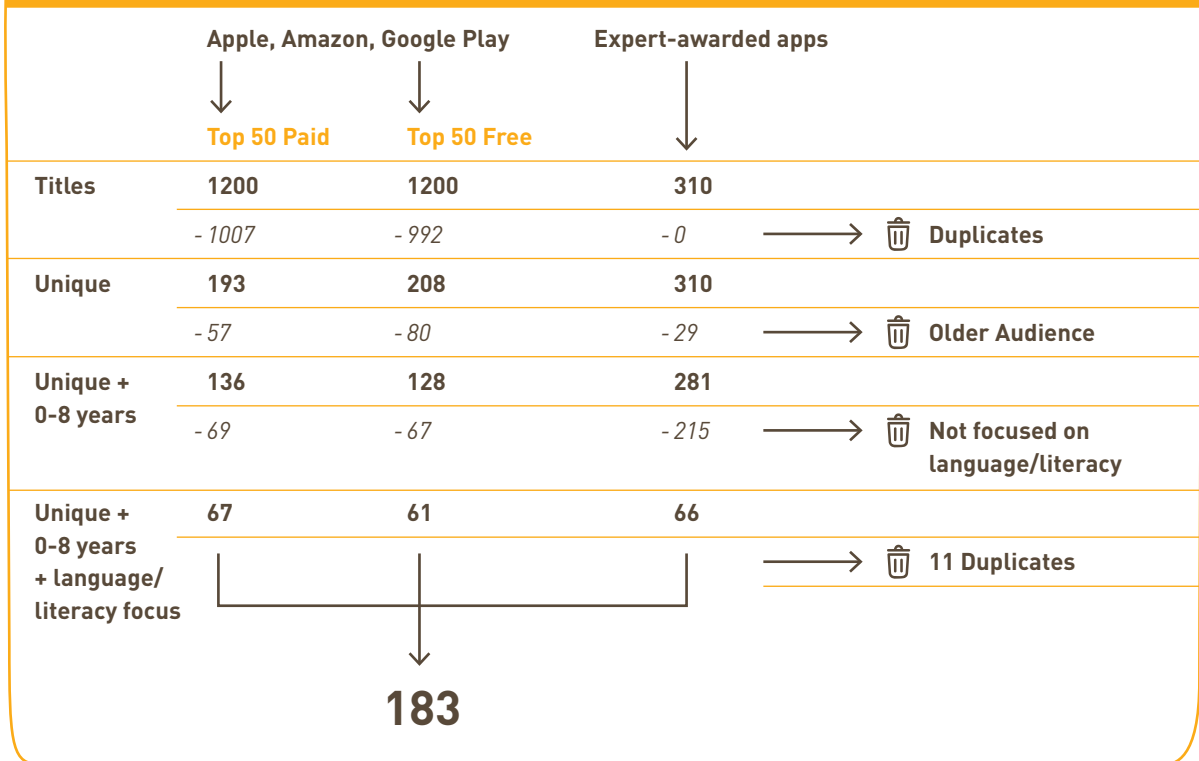
Figure 1: How we derived our sample

	Apple, Amazon, Google Play		Expert-awarded apps	
	Top 50 Paid	**Top 50 Free**		
Titles	1200	1200	310	
	- 1007	- 992	- 0	→ 🗑 Duplicates
Unique	193	208	310	
	- 57	- 80	- 29	→ 🗑 Older Audience
Unique + 0-8 years	136	128	281	
	- 69	- 67	- 215	→ 🗑 Not focused on language/literacy
Unique + 0-8 years + language/ literacy focus	67	61	66	
				→ 🗑 11 Duplicates

183

Next, we catalogued various features through two separate phases of coding (documenting specific features in a systematic way). We noted key aspects of each app's description in app stores and producer websites. We coded basic features, such as the price and size of the app. We also coded the descriptions for mentions of educational elements, including the particular language/literacy skills the app claimed to teach, the education/child development expertise of the design team, and any mention of research testing.[1]

When the first phase was complete, we downloaded each of the apps and documented various features within the apps themselves. We focused on features like the nature of the activities users could engage in, the location and nature of any parent-directed information, and the options users and parents had for customizing the app.[2]

To help shed light on the nature of prominent language- and literacy-focused apps for children—those that parents are likely to find promoted by app stores or awarded by expert review sites—our analyses also took a two-step approach. For each code or feature, we first described the full sample of 183 apps (see Figure 1). Then we compared the frequency or mean value of the features based on the three subsamples of apps (Top 50 Paid in stores, Top 50 Free in stores, and Expert-awarded). For example, we described the range of app sizes for our full sample, and then examined whether Top 50 Paid, Top 50 Free, or Expert-awarded apps tend to be bigger and thus take up more space on devices. Statistical significance is noted where it exists.

[1] Codes were informed by the 2012 market scan (Guernsey et al.) as well as a prior content analysis of infant/toddler DVDs conducted by Vaala and colleagues (2010). For each phase of coding, two members of the Cooney Center research staff coded the sample independently, double-coding 15% of apps. For the first phase of coding (elements of the descriptions of apps in app stores and websites) inter-rater reliability for variables reported here ranged from 78% - 100% agreement. For those variables where kappa values were obtainable, values ranged from $\kappa = .46 – \kappa = .95$ (some codes were too rarely applied for kappa to be calculated).

[2] For the second phase of coding (elements of the actual app content) inter-rater reliability for variables reported here ranged from 82% – 100% agreement, with kappa values between $\kappa = .51 – \kappa = 1.0$.

findings part I: app descriptions

Nuts and bolts

When parents sit down to find an app for a child, they might first notice basic qualities like how many apps are available overall or how much a given app costs. Even the place they go to scout out apps could impact what they find: we noticed that app stores often feature "Top educational apps" that are different from those given high ratings by expert review sites. We were interested in learning more about the kind of information that is available to parents browsing for apps.

Availability and promotion of apps
Parents are likely to find a wealth of literacy-focused apps, whether they browse the popular paid and free educational apps in the app stores ("Top 50" lists) or expert review sites. Before winnowing the original sample of apps down to the final 183, we found that 34% of all Top 50 Paid educational apps, 29% of Top 50 Free educational apps, and 21% of Expert-awarded apps had a language- and-literacy focus and were intended for children from birth to age eight. But parents who search for apps by consulting expert review sites like Common Sense Media, Parent's Choice, or Children's Technology Review are likely to encounter different language and literacy apps than those who search through the top educational apps listed in the app stores themselves. Similarly, searching in one store compared to another will yield a somewhat different pool.

As shown in Figure 2, nearly half the apps in our sample were available in all three markets (the Apple, Google Play, and Amazon app stores). Just under a third were only available in one market. However, these proportions varied based on whether the app came from the Top 50 Paid, Top 50 Free, or Expert-awarded subsamples. The awarded apps were especially likely to be available in only one of the three markets, and they were most commonly available in the Apple store. In fact, each of the 66 apps that were included in our sample as Expert-awarded were available in the Apple App Store, while 27 (41%) were available in Google Play as well, and 25 (38%) were available in Amazon.

Why are the award-winning apps likely to appear only in one market at a time? Often production companies need to make strategic decisions to focus their resources on developing and distributing a higher-quality application for just one operating system, which requires substantial time, effort, and money, before expanding to other platforms. Considerations might include whether their team can handle releasing apps for multiple operating systems, what devices and systems their target market uses, pricing, and distribution strategy.

We were also interested to learn whether the language- and literacy-focused apps that are ranked among the Top 50 lists in app stores are also the ones that tended to win accolades from expert review sites. We found that to a large extent they were not. In fact, only 17% of the apps that had won awards in our sample were also found among the lists of Top 50 Paid or Top 50 Free apps across the three app stores during the same period.[3] One important caveat, however, is that these data were collected at a specific point in time. The apps that happened to be promoted in the Top 50 lists during the eight weeks of our sampling period may have won awards from the same expert review sites before or after this time. Similarly, the award-winning apps may have been among the Top 50 in stores at different times. Still, these data suggest that two parents searching for language/literacy apps for their children at the

The expert review sites we consulted

Common Sense Media
Common Sense Media, a national nonprofit founded in 2003, created the "Best Apps and Games" section of its site primarily for parents. It is free. Funding for the site comes from individual donors, as well as a variety of foundations and other organizations. Apps are rated according to various features. Reviewers are staff members at Common Sense Media, led by an editor with a background in education and child development. The site rates apps along a five-point learning scale, with a 5 signaling that an app is "really engaging" and has an "excellent learning approach," to a 1 for an app "not recommended for learning." Kids and parents can review apps too.
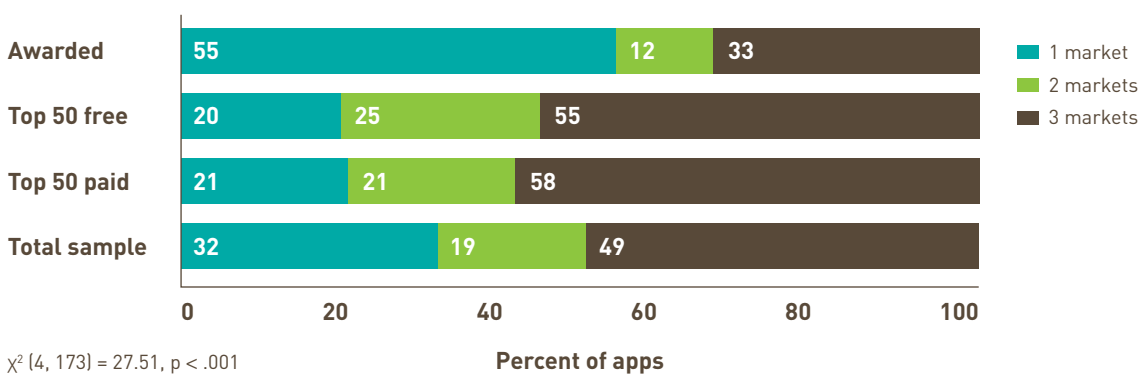
Parents' Choice Awards
Parents' Choice Foundation, funded by processing fees from companies that submit their products for review (the fee is $250 for apps), was started in 1978 to guide parents to books and toys that encourage a love of learning. Reviews are conducted by a core team of five, plus a number of reviewers with specialized experience, using the same guiding principles to rate educational technology that were used to review LEGOs and building blocks. Products that receive a Parent's Choice Award go through a multi-tiered evaluation process. Only about 1 in 5 products submitted receives recognition in any of the six award levels.

Children's Technology Review
Founded in 1993, the Children's Technology Review helps teachers, librarians, publishers, and parents stay up to date on the latest digital products in the children's media market for an annual subscription of $20. Apps are reviewed by educators with preschool or elementary school teaching experience who look at products with the question, "what does a child walk away from the experience with, that he or she didn't have when first coming to the experience?" Apps are awarded a letter grade and broken down into categories including ease of use, educational, entertaining, design features, and good value.

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[3] In analyses which compare apps by subsample, the 11 apps that were in the Expert-awarded and Top Paid or Top Free samples were removed in order to have mutually exclusive groups. Thus, the Top 50 subsamples should be interpreted as the Top Paid or Top Free apps that did not win accolades from expert review sites, and the Expert-awarded sample should be interpreted as apps that received high rankings from one or more of the review sites and were not among the Top 50 lists in app stores. Analyses that involve the full sample still contain the 11 apps.

Figure 2: Availability of apps in multiple markets (Apple, Google Play, and Amazon app stores

	1 market	2 markets	3 markets
Awarded	55	12	33
Top 50 free	20	25	55
Top 50 paid	21	21	58
Total sample	32	19	49

Percent of apps

$\chi^2 (4, 173) = 27.51, p < .001$

same time but through different means—one by scanning through the "top" educational apps in an app store and the other by consulting expert review sites—are likely to encounter almost completely different apps.

Price
A family's decision to download an app may rest in part on its cost. In 2012, the Federal Trade Commission found that children's apps ranged in price from free to $9.99, but the bulk were $0.99 or less (77%) (FTC, 2012). The FTC also determined that apps costing $0.99 or less accounted for an estimated 99% of downloads.
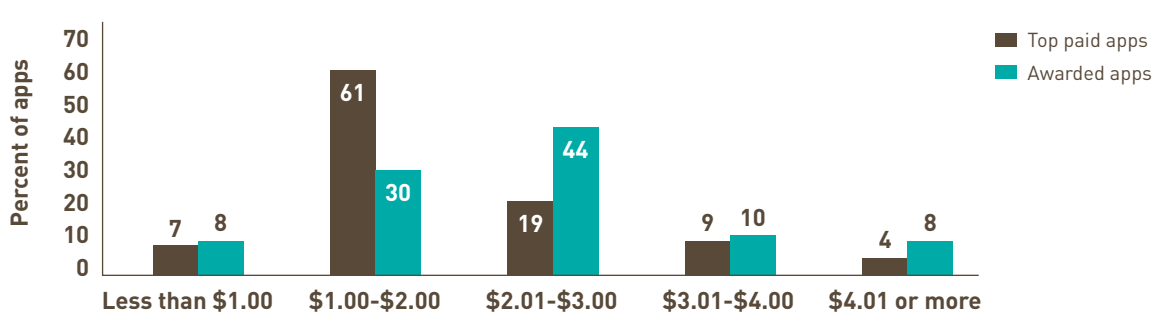
As we collected our sample in part based on whether apps were free or paid, we wondered in particular about the range in price among the paid apps. The paid apps in our sample ranged from

$0.99 to $10.00 or more. Unlike the findings from the FTC report (2012), our paid apps reflected more diversity in price (see Figure 3). However, these rates are not directly comparable, given that the samples were collected through different processes: our sample includes only top educational apps and expert-awarded apps that promote language or literacy skills while the FTC's sample of 400 apps was chosen randomly from kids' apps in the Apple and Android markets.

Since the majority (88%) of award-winning apps in our sample were paid, we also wondered how their prices compared to paid apps from the "top 50" lists in app stores. We found a small but statistically significant difference in the mean price of apps which indicated that Expert-awarded tended to cost $1–2 more than the Top 50 Paid apps on average (see Figure 3).

Figure 3: Prices of Top 50 Paid and Awarded apps

	Less than $1.00	$1.00-$2.00	$2.01-$3.00	$3.01-$4.00	$4.01 or more
Top paid apps	7	61	19	9	4
Awarded apps	8	30	44	10	8

Percent of apps

$t(110) = -2.57, p < .05$

Families with greater disposable income may be more likely to pay more for children's educational apps than those with lesser means. In 2013, Common Sense Media published a survey revealing an "app gap," in which lower-income families were less likely to have access to high-speed Internet and mobile devices. It also found, when looking only at families with mobile devices, differences in how many of them downloaded educational children's apps based on income level (i.e., 57% of low-income families with devices owned educational apps, compared to 64% of middle-income and 80% of higher-income families). To the extent that Expert-awarded educational apps are in fact of higher-quality and tend to be more expensive, these price differences may continue to perpetuate this gap. That is, children from higher-income families will continue to end up with higher quality apps, compared to those from less-advantaged backgrounds whose parents are less likely to purchase expensive apps.

Size
"Storage Almost Full:" These three words are likely to frustrate any user in pursuit of new apps. Apps in our sample varied a great deal in size, from less than 1 MB to 3 GB (3,000 MB). On average, they were around 96 MB (SD = 181). The apps' sizes did not vary by subsample; the sizes among the Top 50 Paid and Free apps were similar to those of the Expert-awarded sample. We also did not see a significant relationship between app size and price in our analyses.

While this remains an understudied area, it is reasonable to expect that differences in app size can have real implications for whether a family downloads an app or how long it is kept it on the phone or tablet. Many parents may not be aware that some apps take up space as they are used, especially those that keep photos, maintain progress reports, or offer messaging systems. But an app that takes up a significant amount of space on a device may actually offer more content for the user to interact with and learn from.

Follow-up research should determine parents' perceptions, if any, of app size when making downloading decisions, as well as any correlations between size and amount of content or educational value.

Packaging and promotion: How apps describe themselves

After considering the basic characteristics of the apps in our sample, we turned our focus to more subjective information provided in the descriptions, found within the app stores and on producers' websites, which are the prime means through which a parent can determine an app's content and whether it is appropriate and potentially worthwhile. Our goal was to determine how much and what kind of information was available to parents as they decided whether or not to download language- and literacy-focused apps.
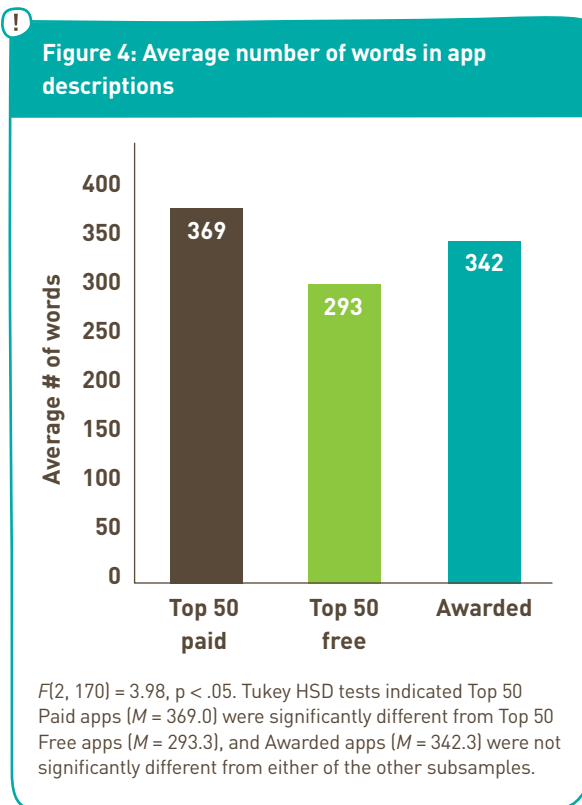
App description length
We were curious about the sheer amount of information parents, educators, and other caregivers would receive through descriptions across the app stores. Did producers provide just a sentence or two to describe content, or did they offer more information to guide parents' decision-making? We also wondered if the amount of information provided might vary by whether the app was in our Top 50 Paid, Top 50 Free, or Expert-awarded subsamples. We did not specifically focus on differences between the different app stores.[4]

The number of words in any given description varied widely, from 13 to 1,089 words. To put these quantities in perspective: a typical single-spaced page of text using 12-point font holds approximately 500 words.

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[4] Each of the app stores has a different set of rules that determine how a developer submits an app, from screenshots to guidelines that govern word counts for the descriptions and keywords. The stores treat the content of these descriptions in different ways, too. For example, all of the words in an app's description in the Google Play store are searchable, whereas in the Apple App Store, apps are only searchable by title and keywords.

We counted the number of words in the description of each app in each store in which it was available. For those available in more than one app store we averaged the word tallies for a mean number of words. The descriptions in our sample contained 332.5 words on average (SD = 147.7). The number of words in any given description varied widely, from 13 to 1,089 words. To put these quantities in perspective: a typical single-spaced page of text using 12-point font holds approximately 500 words.

Figure 4: Average number of words in app descriptions

F(2, 170) = 3.98, p < .05. Tukey HSD tests indicated Top 50 Paid apps (*M* = 369.0) were significantly different from Top 50 Free apps (*M* = 293.3), and Awarded apps (*M* = 342.3) were not significantly different from either of the other subsamples.

When looking across our subsamples we noticed differences in the number of words that tended to be in app descriptions. As shown in Figure 4, those that were among the Top 50 Paid apps in stores tended to have the most words in their descriptions, especially in comparison to the Top 50 Free apps. Those that had won awards from expert review sites fell in the middle. The difference between the typical number of words in Top 50 Paid and Top 50 Free app descriptions (76 words) was statistically significant, but not particularly large.

A description that is 200 words long and lays out the curriculum and expertise that guided the app's development, the specific skills taught by the app, and the target age of users is more informative than a 600-word passage that merely describes the app's plot.

To some extent, the place parents go to look for apps may play a role in how much information they are able to see about those apps. Parents who scout for language and literacy apps through expert review sites or who look among app stores' "Top paid educational apps" will likely encounter apps that give slightly more information than those who look for apps among the "Top free educational" apps promoted in the stores. However, while parents who search for Top Paid apps or consult expert review sites may encounter somewhat longer descriptions overall, this may not matter if there are not also differences in the kinds of information they encounter. For example, a description that is 200 words long and lays out the curriculum and expertise that guided the app's development, the specific skills taught by the app, and the target age of users is more informative than a 600-word passage that merely describes the plot of the app and other apps created by that particular producer.

Target age
A parent searching for an app for a 2-year-old is likely to be interested in teaching her child basic skills, such as alphabet recognition; the same parent may want an app that teaches a different set of skills, such as handwriting practice or spelling, for a 6-year-old. In an NPD study (2012) on parental behavior when making app purchases, more than two-thirds of parents surveyed search for age-appropriate content specifically. In addition, three quarters of parents with kids ages 2 to 5 look for age-appropriate apps when putting in search terms. This is especially interesting given that more than 60% of parents said the app store is their go-to place to find apps for their children,
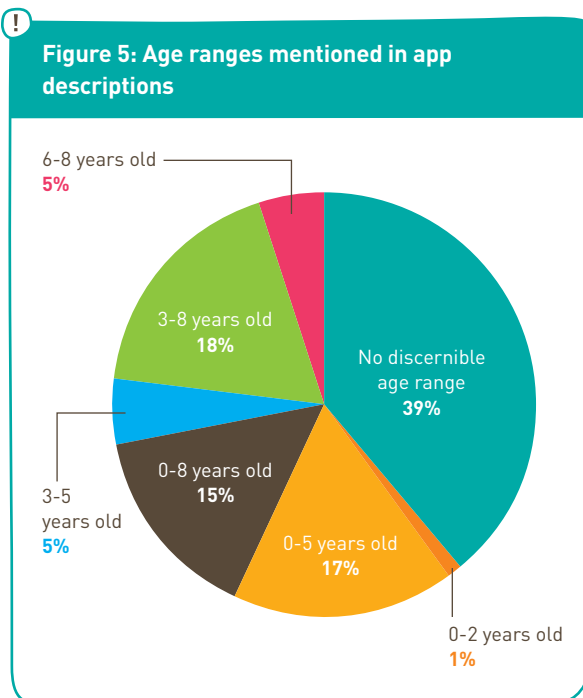
instead of a review site like Common Sense Media that lists apps according to age-appropriateness based on a defined system (NPD, 2012).

In terms of early literacy skills, the years between birth and age 8 represent a relatively sizeable range that contains diverse developmental stages. Interestingly, we found that nearly 40% of app descriptions/websites in our sample did not clarify the age-range for the target users of the app at all, simply mentioning "children" or "kids" as their target users.[5] We felt this rate was low; yet it was somewhat more promising compared to an analysis of children's apps conducted by the FTC in 2012 in which only 23% of the apps sampled gave a particular age range or grade.

Of further interest was whether apps that did indicate age range tended to mention fairly narrow ranges as their target audience, and whether particular subsets of ages were more or less represented in the target age-ranges of the whole sample. Among the apps that do mention an age-range for users, the vast majority (90%) cite preschool-age children as at least part of their target audience. Often, the apps target a

range that is broader than a two-year span. That is, many of the apps that targeted preschool-age children also mentioned younger (0–2 years) and/or older children (6–8 years) as well (see Figure 5). In fact, the proportion of apps that give only a three-year age span makes up only 11% of the full sample. We did not find differences in whether apps mentioned specific age ranges or which age ranges were targeted based on the subsamples (Top 50 Paid, Top 50 Free, and Awarded apps).

The lack of specificity in age range may be a source of frustration for parents. While it might be clear from descriptions that an app is intended for young children, there seems to be a lack of guidance in many descriptions in the app stores. In our analysis, we found that nearly 40% of the apps in our sample did not mention a target age or developmental stage of users at all, and an
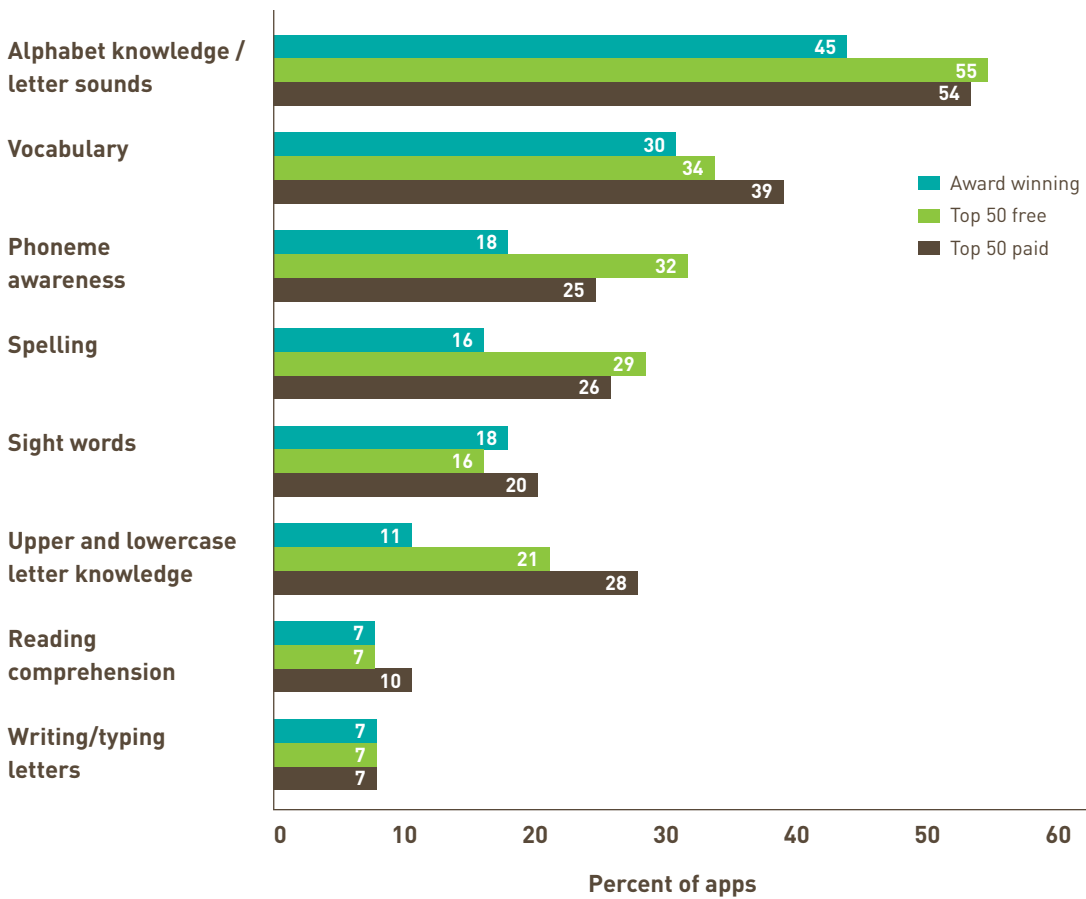

Figure 5: Age ranges mentioned in app descriptions

6-8 years old **5%**
3-8 years old **18%**
3-5 years old **5%**
0-8 years old **15%**
0-5 years old **17%**
0-2 years old **1%**
No discernible age range **39%**

23 skills that enable children to become strong readers

1. basic speech production
2. alphabet/letter knowledge
3. phonemic awareness
4. writing/typing individual letters
5. lower-versus upper-case letter identification
6. print concepts (the form/function of print)
7. vocabulary
8. spelling
9. storytelling/narrative sequencing
10. recognizing sight words
11. reading comprehension
12. rhyming concepts
13. grammar
14. learning a foreign language
15. handwriting
16. reading fluency
17. written expression
18. spoken expression
19. sign language letters
20. sign language words
21. sign language phrases
22. literary forms/genres
23. motivation/love of reading

[5] The apps made it into our sample because they mentioned skills or teaching that would be appropriate for children within the 0–8-year range (i.e., they were clearly not for older children or teenagers).

Figure 6: Most common language and literacy skills targeted in apps

Legend:
- Award winning
- Top 50 free
- Top 50 paid

Alphabet knowledge / letter sounds: Award winning 45, Top 50 free 55, Top 50 paid 54

Vocabulary: Award winning 30, Top 50 free 34, Top 50 paid 39

Phoneme awareness: Award winning 18, Top 50 free 32, Top 50 paid 25

Spelling: Award winning 16, Top 50 free 29, Top 50 paid 26

Sight words: Award winning 18, Top 50 free 16, Top 50 paid 20

Upper and lowercase letter knowledge: Award winning 11, Top 50 free 21, Top 50 paid 28

Reading comprehension: Award winning 7, Top 50 free 7, Top 50 paid 10

Writing/typing letters: Award winning 7, Top 50 free 7, Top 50 paid 7

Percent of apps

additional 50% mentioned fairly broad age ranges for whom the app was appropriate (i.e., 0- to 5-year-olds). Thus, parents choosing from popular app lists or expert review sites may end up downloading apps with content their children have already mastered or content that is too advanced.

Language and literacy skills
To become proficient at reading and communicating with language, a child must master a number of different skills between birth and age eight. These grow in complexity, from producing basic sounds to reading fluently and understanding what is read (see Guernsey & Levine, 2015). We wondered whether we would find apps in our sample that specified which skills were targeted by the app content, and further,
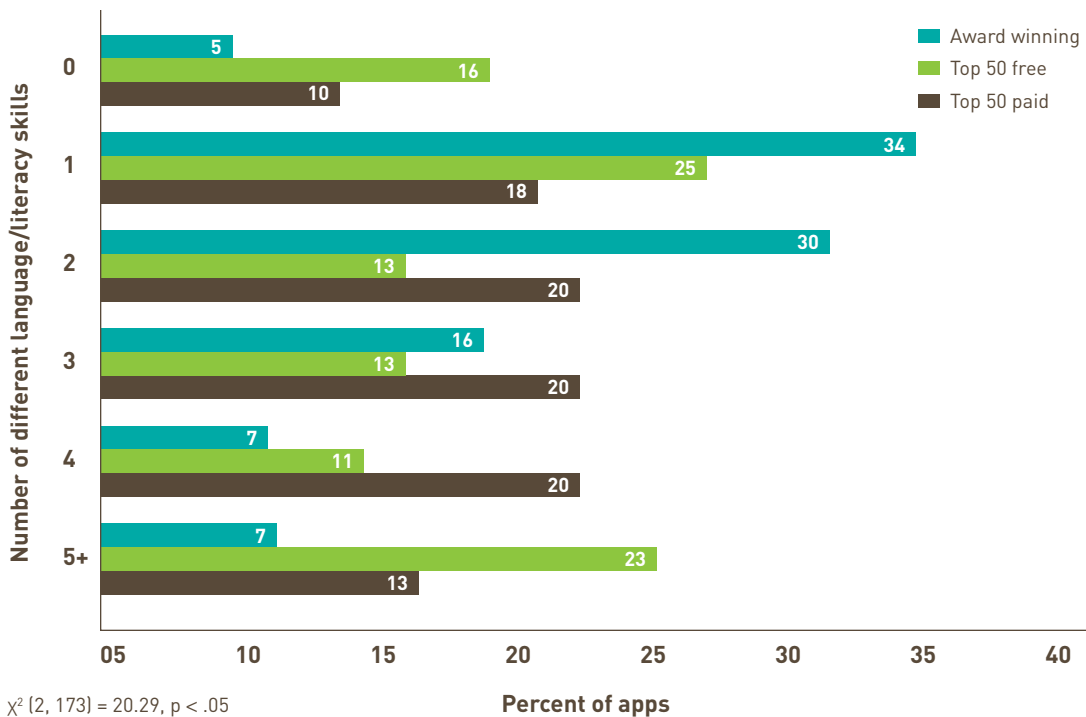
whether those would be representative of the wide range of skills children need to develop to become proficient readers and communicators.

Within each description, we documented whether only general language- and literacy-learning was mentioned (e.g., "this app teaches language and literacy skills"), or if specific competencies were listed (such as vocabulary development or reading fluency). When specific skills were mentioned we catalogued which ones were targeted from a list of 23 different skills. We culled these particular skills from literature and curricula on language and literacy development from birth through age 8.

We found that most of the apps in our sample (90%) did mention at least one particular language or literacy skill, such as vocabulary development

Figure 7: Number of different language/literacy skills mentioned in app descriptions

Legend: Award winning, Top 50 free, Top 50 paid

Number of different language/literacy skills	Award winning	Top 50 free	Top 50 paid
0	5	16	10
1	34	25	18
2	30	13	20
3	16	13	20
4	7	11	20
5+	7	23	13

Percent of apps

$\chi^2 (2, 173) = 20.29$, $p < .05$

or phonemic awareness. However, as shown in Figure 6, the bulk of the competencies we found fell across eight specific skills out of the 23 we looked for. For the most part, these were fairly basic skills, many of which are most appropriate for the preschool and kindergarten audience (e.g., phonemic awareness; sight words; recognizing lowercase and uppercase letters). This finding is not surprising in light of the fact that most of the apps in our sample targeted preschoolers. We found many of the same skills represented across apps in our 2012 market scan as well (Guernsey et al.). However, our analysis reveals a trend towards promoting a few more advanced literacy skills, like vocabulary development and reading comprehension, for children eight years old and younger. Still, a number of the higher-order skills

The majority of Award-winning apps (61%) claimed to teach only one or two language/literacy skills.

that we looked for were rarely or never encountered in this sample of apps (e.g., self-expression; reading fluency), suggesting popular and highly promoted apps still under-represent the skills for the older children in our target age range.

We also looked for possible differences in the specific language/literacy skills that Award-winning apps claim to teach, compared to the Top 50 Paid and Free apps. Our analysis reveals the same few skills across all three categories. In each of them, teaching basic skills like alphabet/letter sound knowledge and vocabulary development was the most common, and these were found at similar rates in app descriptions.

Next, we computed a sum for each app of how many *different* skills were mentioned in its description. The findings from this analysis shed some light on the finding above. As shown in Figure 7, the majority of Award-winning apps (61%) claimed to teach only one or two language/ literacy skills based on their descriptions. This

was the case for only 36% of Top Paid apps and 40% of Top Free apps, which were each more likely to target three or more different skills in a single app. What is more, the Award-winning apps were most likely to mention at least one specific language/literacy skill in their descriptions; only 5% of Award-winning apps did not mention language/literacy-learning at all or claimed to target only general language/literacy development with no mention of specific skills. Conversely, 9% of Top Paid and 15% of Top Free app descriptions mentioned no specific language/literacy skills targeted by the apps.

While our analysis has demonstrated that parents are likely to find a wealth of language- and literacy-focused apps for young children in general, many will be frustrated if they are searching for apps that target particular skills. Parents with children who are school-age or have already mastered basic language/literacy skills may especially struggle to locate the apps they want among the Top Educational apps in app stores and Expert-awarded apps. Families searching for apps that teach higher-order skills, like reading fluency, storytelling, or self-expression, may have to search beyond top app lists and award-winning reviews to find these resources. On the other hand, those looking to help children learn the basic building blocks of language and literacy, such as the ABCs and the sounds that letters make, will find themselves with an abundance of options to choose from. These findings suggest that what we consider the most prominent apps—those listed among the Top Educational apps in app stores and recommended by expert review sites—do not contain a mix of the full set of language and literacy skills necessary to become a proficient reader and communicator.

When searching expert ratings sites, parents will likely come across more apps with a focus on just a few language/literacy skills. Those hoping to address more skills with a single app may have more success among the offerings in the Top Educational app lists in app stores. It is not clear whether experts deem a narrow learning focus within apps to be a positive attribute, or if apps that experts prefer simply tend to focus on fewer skills. Similarly, to our knowledge, there is no

published research indicating whether children learn better from apps that target just one or two skills, or whether it might be beneficial to incorporate a range of learning objectives. These findings highlight an important gap where more work is needed. Empirically-based guidelines for how narrow an educational app's learning objectives should be, and whether the parameters vary by subject, could aid parents scouting for high-quality educational apps.

Benchmarks of educational quality

Many parents searching for language- and literacy-focused apps for young children are likely on the lookout for what we consider to be fairly standard benchmarks of educational quality in children's media products: relevant expertise on the development team, an underlying curriculum guiding content development, and research testing of the program's usability and efficacy. A wealth of research indicates that characteristics like these reflect purposeful design and development decisions in educational media, which tend to boost the likelihood that children will learn their intended content (Anderson et al., 2001; Fisch & Truglio, 2000a).
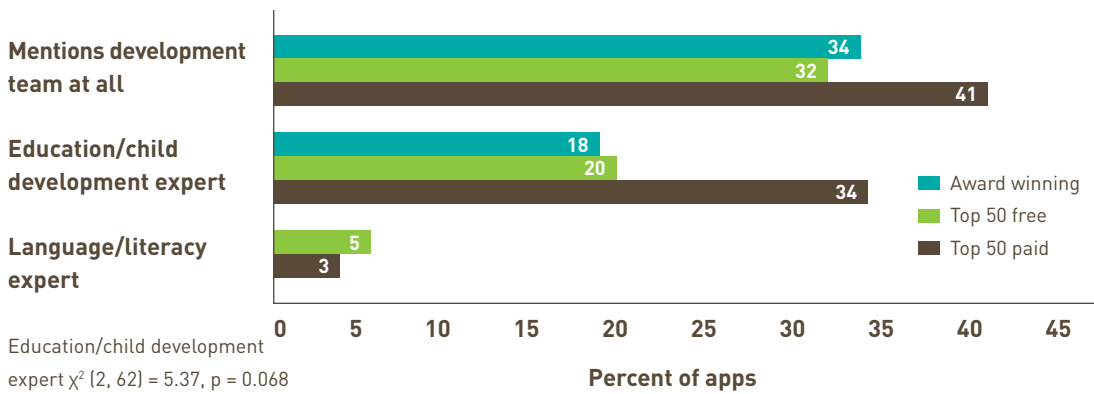
Development team
To what extent are parents likely to encounter information about an app's development team? If such information was available, would parents learn whether child development, education, or literacy experts had been involved in development? We reviewed the apps in the sample to see whether they included information about the development team either in the product description or affiliated producers' website (we found most of this information on the producers' websites), and whether app descriptions mentioned the participation of child development, education, or literacy experts.

We determined that less than half of the popular Paid, Free, and Award-winning apps provide information about their development teams. As shown in Figure 9 (p. 23), trends suggest that a slightly higher percentage of Top 50 Paid apps had information available about the development team,

Figure 8: Most common language and literacy skills targeted in apps

Mentions development team at all
- Award winning: 34
- Top 50 free: 32
- Top 50 paid: 41

Education/child development expert
- Award winning: 18
- Top 50 free: 20
- Top 50 paid: 34

Language/literacy expert
- Top 50 free: 5
- Top 50 paid: 3

Percent of apps

Education/child development expert χ^2 (2, 62) = 5.37, p = 0.068

compared to Top 50 Free or Expert-awarded apps. However, these differences were not statistically significant.

The percentage of apps that indicated that education or child development or education experts participated in development was smaller still. We noted, however, that these proportions are quite high if you look only at apps that have published information about the development team. Of the apps that do have information available about the development team, 84% of Top Paid, 61% of Top Free, and 53% of Award-winning apps had *education or child development experts* as part of the team or consultants. These differences reached marginal statistical significance (p = 0.068).

On the other hand, only 8% of the Top Paid and 17% of the Top Free apps with information on the development team mentioned a *literacy expert or consultant* on the team (five total apps in our full sample). None of the Award-winning apps mentioned a literacy expert or consultant in app descriptions or on producer websites. These trends did not reach statistical significance in our findings.

Given the relative rarity of development team information at all, we combined education and child development experts with language/literacy experts to see if apps varied by subsample in those that mention at least one of these types of experts' involvement in development (see Figure 9).

Figure 9: Percent of apps that mentions education, child development, and/or language/literacy expert in development team

Percent of apps
- Top 50 paid: 36
- Top 50 free: 20
- Awarded: 18

χ^2 (2, 173) = 6.39, p < .05
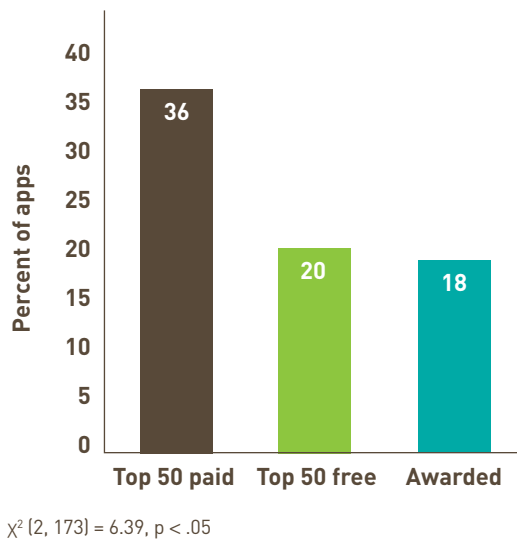
We found that the Top 50 Paid apps from app stores were more likely to mention education, child development, and/or language and literacy experts when they give information about the development team, compared to apps among the Top 50 Free or Award-winning lists.
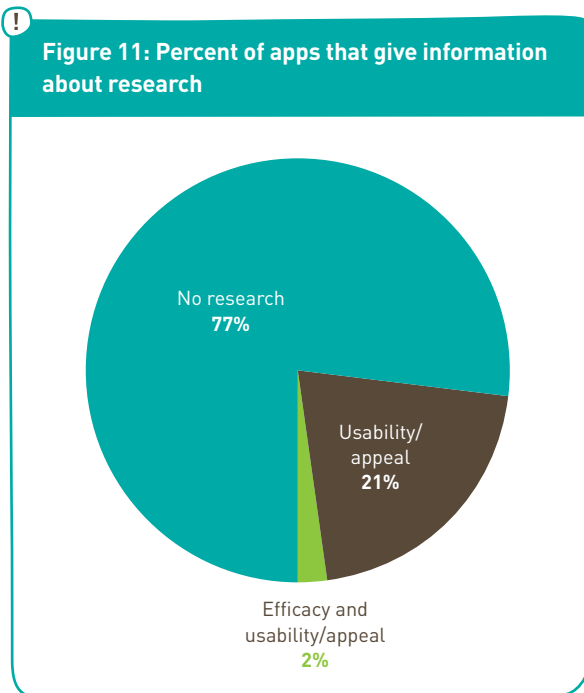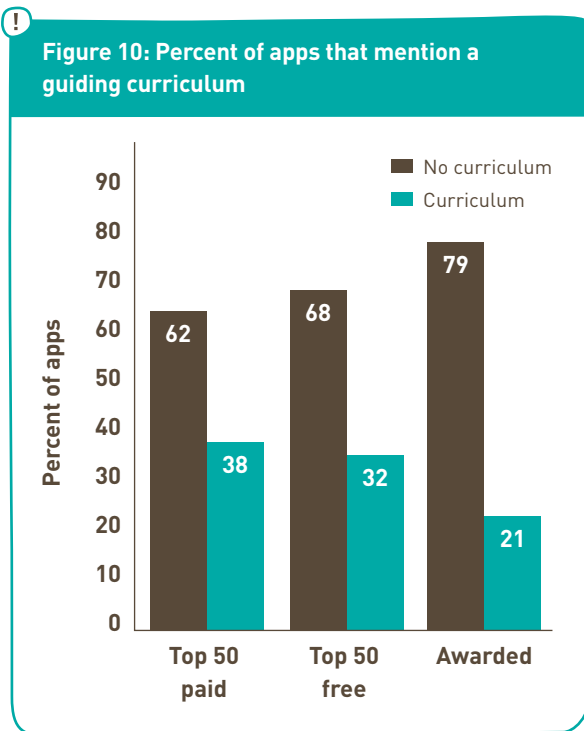
Guiding curriculum
Another feature we looked for in app descriptions was a reference to an underlying educational

curriculum. It seemed to us that applying an educational curriculum to guide content development was likely a sign of a quality app, or at least that parents would perceive a guiding curriculum as an indication of educational quality. Most parents would not send their children to a school with no overarching teaching philosophy. Similarly, television programs like *Sesame Street* or those produced by PBS have clear, underlying curricula (as well as research evaluating curricula goals), and are considered the gold standard for kids' educational programming (Anderson, 1998; Anderson et al., 2001; Fisch & Truglio, 2000; Wilder, 1996).

We coded descriptions for any mention of a guiding curriculum in app development. We applied a liberal standard here; the description did not have to use the exact word "curriculum" (e.g., "teaching philosophy" was fine), and we marked an app for this feature even if the name of the curriculum was not stated or the curriculum had been created by the development team. The breakdown of apps in each subsample that mention an underlying curriculum or not is displayed in Figure 10.

Fewer than a third of the apps in our sample made any mention of having a curriculum (29%). Of the 53 apps that did mention a curriculum, the majority (64%) named a specific curriculum underlying the app's development. The most commonly mentioned was Common Core (17 apps), followed by Montessori (7 apps).

When looking at trends, Award-winning apps were less likely to mention a curriculum in their descriptions (18%) compared to Top Paid (34%) and Top Free apps (30%). However, these differences did not reach statistical significance. Furthermore, these rates may not reflect actual differences in the use of curricula or of quality. Because we coded only app descriptions, we do not know the extent to which curricula were integrated into development in those apps that mention curricula. Similarly, the fact that a curriculum is not mentioned in an app's description does not mean that one was not used in development. Finally, our presupposition that a specific, guiding curriculum reflects quality in apps is a naive theory, as no known research has tested this premise.

Figure 10: Percent of apps that mention a guiding curriculum

Figure 11: Percent of apps that give information about research

Testing

Given that the apps in our sample are listed as "educational" state or imply that children will learn various language- and literacy-related skills from them, we wondered whether there was any information provided in descriptions about

What accounts for differences in benchmarks of educational quality?

We were surprised to find that apps that had been given awards by expert rating sites were not the most likely to mention any of the three types of "benchmarks" of educational quality in their descriptions (i.e., child development/ educational expertise; guiding curriculum; testing). In fact, mentions of these aspects were most frequently encountered among Top 50 Paid apps. It is important to interpret these patterns with caution, as they do not necessarily signify differences in the quality of the apps. Rather, they represent some differences in the nature of information communicated to parents within the app descriptions. Each of these three benchmarks may be equally (or even more highly) represented within Award-winning apps as Top 50 Paid apps, though their descriptions may not mention them as readily. Hence, parents who scout for apps among the Top 50 Paid educational apps in stores may come away perceiving that more language and literacy apps tend to include experts in the development process, have an underlying educational curriculum, and undergo testing (particularly for usability and appeal). Typically, detailed information about each of these attributes was not provided by producers. For example, when the participation of child development or education experts was mentioned, it often was not made clear how exactly these figures contributed to the app's development. Such participation could presumably vary widely, from actively assisting in the conceptualization, design, and testing of the app, to merely giving an endorsement of the finished product. These patterns in our findings underscore the need for more detailed information about app development for parents and educators, as well as greater regulation and transparency in the qualities needed to justify marketing an app as "educational."

efficacy or even usability testing of the apps, so we coded store and producer website descriptions for any mention of research testing. Fewer than a quarter of app descriptions mentioned testing usability or appeal (see Figure 11). Overwhelmingly, this testing was conducted with child users (86%), although 5% of apps were tested with parents only, and 7% were tested with both parents and children; 2% did not mention who participated in the testing.

More noteworthy is the absence of information about any testing of children's *learning* from the apps. Only 2% of apps directly mentioned that research was conducted to assess learning from the product. It is likely that more producers conduct this sort of testing, but are not including that research in app descriptions. In particular, we suspect that some of the producers who also create children's educational television programming test the efficacy of their apps, as they tend to conduct research on children's learning from their television programming.

Follow-up analyses did reveal some differences in whether research was mentioned in descriptions based on where the apps came from. Figure 12 shows that apps in the Top 50 Paid sample were more likely to mention some form of research testing, compared to those in the Top 50 Free and Expert-awarded samples.

Figure 12: Percent of apps that mention any kind of testing at all
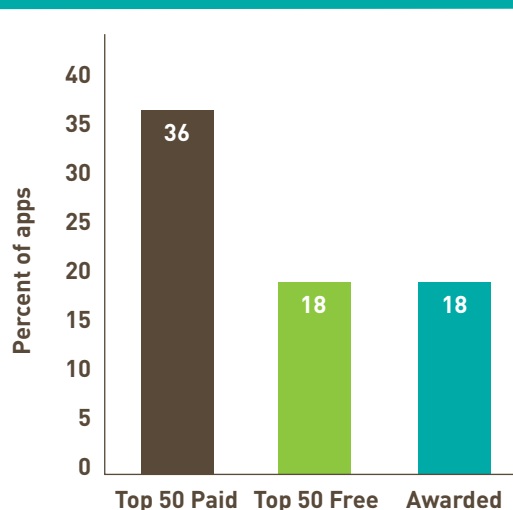
findings part II: app content

Nature of app content

Our second round of coding involved downloading all of the apps and cataloguing various aspects of their content. Our goal was not to make judgments about the apps' educational value, but rather to document the presence of certain features, such as the kinds of activities and characteristics in the apps, what kind of information was provided for parents within the apps and where it was located, and what opportunities families had to customize the apps. Similar to analyses pertaining to app descriptions, we first examined the full sample of apps, and then looked for differences based on where parents go to look for apps (i.e., between the Top 50 Paid, Top 50 Free, and Expert-awarded apps). We should note that the remaining analyses were conducted with a sample of 170 apps, because when we went to download our original selection,13 were no longer available.[6]

[6] Because the second phase of our study (which required downloading all the apps) began seven months after the original data collection, 13 of the apps were no longer available or had changed so significantly as to no longer constitute the same app associated with the description we had coded.

Types of activities

We recorded whether each app had the following activities: storybooks, other narratives that were not books (e.g., video stories), games, puzzles, or quizzes (these three activities were coded as one category as it was very difficult to distinguish between them in many cases), tracing activities (these mostly entailed tracing letters and numbers), coloring or sticker activities, songs, and tutorials or lessons (these were non-narrative presentations of educational information). "Other interactive activity" was used to document those activities that did not fall into any of our other categories: examples included creating your own storybook, recording video stories and sharing them, and various other user-generated content activities.

As shown in Figure 15, games, puzzles, and quizzes were the most commonly encountered form of activities in the apps we coded (71%), regardless of category. These activities have right and wrong answers or actions, rather than open-ended designs that allow children create their own content or explore without getting something "wrong."

We also found that apps that had won awards from expert review sites were somewhat more likely to contain storybooks (37%) than apps from Top 50 Paid (20%) or Top 50 Free subsamples (19%).[7] As a follow-up analysis we combined the categories for storybooks and non-storybook narrative to form a combined category to see whether apps contained at least one of these narrative activities. We found that 56% of Awarded apps had a storybook, non-storybook narrative, or both, while only 39% of Top 50 Paid apps and 29% of Top 50 Free apps had one or both of these activities.[8]

Research into young children's learning from educational television indicates that narrative-style programming can be effective for promoting language development (Linebarger & Walker, 2005). Narrative-style content is often very appealing to children and represents a style they are already familiar with, from reading storybooks with

> **⚠ Using games thoughtfully in children's apps**
>
> In a report about the considerations for using technology in early childhood education programs, McManis and Gunnewig (2012) explain that educational content presented in an app or other media "in the context of a game can be appropriate, but not when the object is winning over learning" (p.19). In a qualitative examination of 5-year-olds' use of apps in the classroom, Falloon (2013) observed that the students generally enjoyed apps that included game-like activities. However, the way the game-like activities were designed and implemented had crucial implications for how children engaged with them and what they got out of them. For example, some apps did not give enough guidance on the goal of the game or puzzle or how to play, and others did not give any or sufficient feedback regarding incorrect answers or actions. In these cases children became frustrated, merely played around to see what the app would do if they tried different actions unrelated to the goal of the app (such as drawing pictures instead of letters in a tracing game), or closed the app and moved on to a different one. Most children did not show that they had learned the intended content from games or game-like apps with these design drawbacks. Whether and what children learn from apps with puzzles, games, and quizzes depends on the design and features of these activities.

parents and others. Furthermore, narratives often feature dialogue between characters which models language use and can demonstrate the meaning of new words (Linebarger & Walker, 2005). Our findings suggest that parents who scout for language- and literacy-focused apps by consulting expert review sites are likely to find apps that have storybooks and/or other narrative activities. Those who search through the "top" educational apps in app stores will likely encounter fewer products with narrative features. Experts may see the value of narrative-style elements for children's language and literacy learning and rate these apps highly.

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[7] We excluded apps that were only storybooks from the full sample. Thus, these apps contained storybooks in addition to other interactivities, such as puzzles or quizzes.

[8] $\chi^2(2, 160) = 7.91$, $p < .05$.

Fisch's capacity model of children's comprehension

While it is promising to see so many narrative activities, including storybooks, within the apps we studied, developers should be mindful of how these elements are designed and incorporated. The way that content is presented within a narrative has important repercussions for children's learning. In "A Capacity Model of Children's Comprehension," Fisch (2000) examines the way children use their cognitive resources while viewing educational television. He contends that the narrative content of programming is primary and children's cognitive resources are first dedicated to following the story. Remaining resources are then applied to understanding educational content. The more tightly entwined the educational content is with the narrative content, theorizes Fisch, the easier it is for children to follow both, leading to deeper comprehension of the educational content. When the educational content is tangential to the story—the content does not tie into the story's plot—children need to direct greater cognitive resources to understand what is being taught. In those cases, learning often suffers.

Figure 13: Types of activities in apps

Storybooks χ^2 (2, 160) = 5.47, p = 0.065.
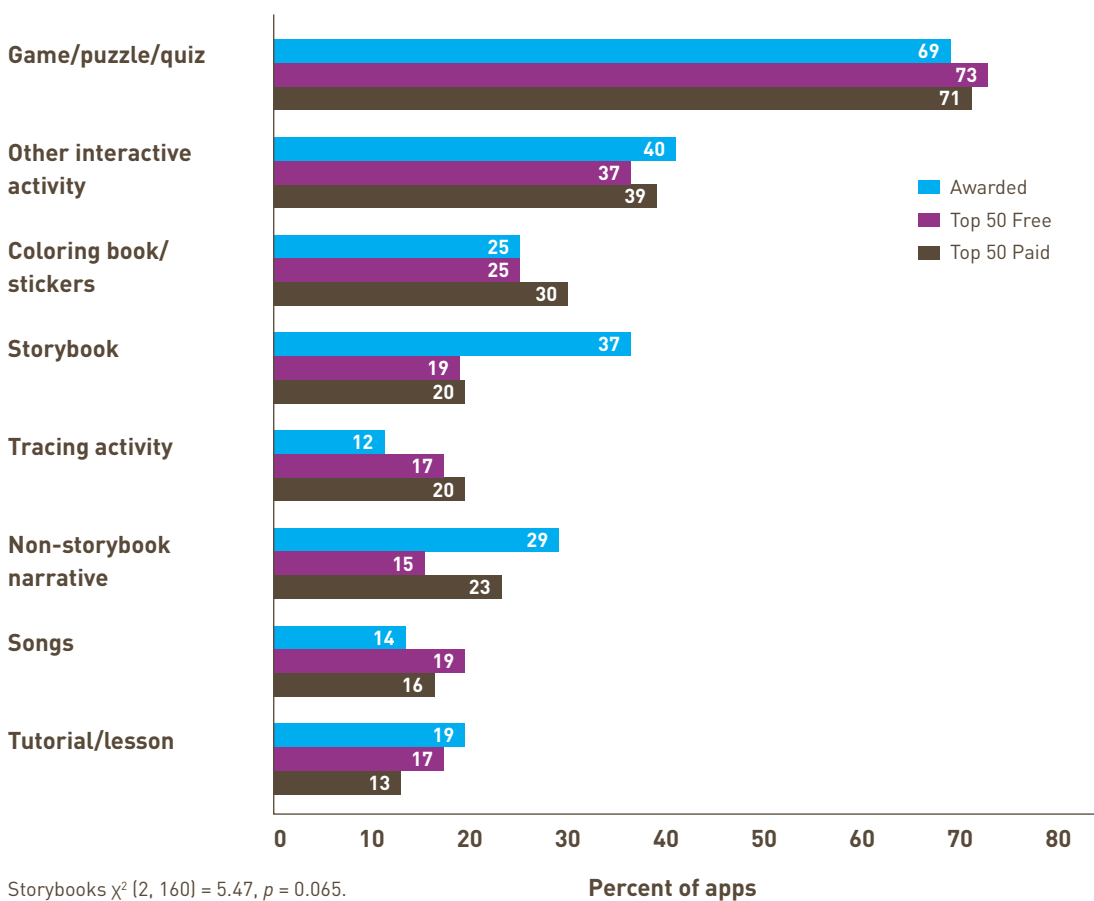
Features

In addition to activities within the apps, we were curious about the more nuanced features that might appear within the activities. When children sit down to play the games, view the storybooks, or otherwise engage with the content, what tools and mechanics are they presented with? We looked for several features that might be expected in educational language- and literacy-focused apps, including word translators, dictionaries, and storybook narration. We also checked for more general app features like hotspots, animation, looping content, the ability to input a user's own voice or images, "rewards" for user progress, and the ability to send content to a printer.

The distribution of these features across our sample of 170 apps is shown in Figure 16 (p. 32). The distribution of the features did not vary significantly between apps from different subsamples, with one exception: Expert-awarded apps were more likely to contain book narration (48%), compared to Top 50 Paid (25%) and Top 50 Free apps (25%). Given the trend for award-winning apps to contain more storybooks, as described above, this was not surprising.

Nearly all 170 apps contained animation, which is hardly surprising, since animation may serve to attract and hold the attention of young users better than static designs might. However, the benefits of animated content within children's educational apps and the conditions under which it is most useful for learning remain to be confirmed with research.

The prevalence of audio narration makes sense too, as so many of these apps target children who cannot yet read on their own, and many contained narrative activities as described above. We observed that usually the narration could be turned off and on for stories within the apps, offering a valuable opportunity for parents to co-use the apps with their children, further scaffolding a child's understanding of the content. Storybooks and other narratives that display the text on the screen while also offering audio narration can help emerging readers see and hear words simultaneously. More research is needed into the ways that these features are implemented within apps and how presentation may impact their value as scaffolding tools.

Figure 14: Features in apps
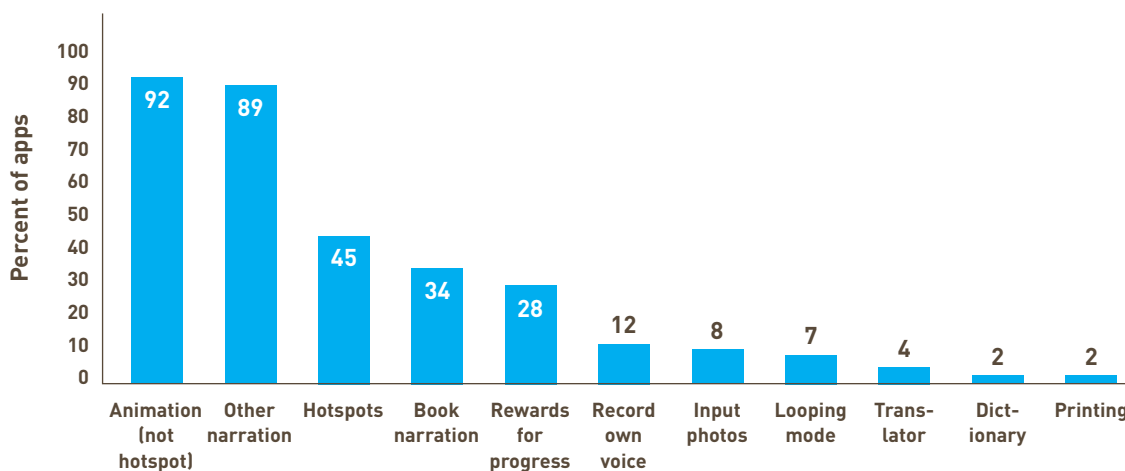
Awarded apps more likely to contain story narration, $\chi^2 (2, 160) = 8.52$, $p < .05$

Nearly half of the language- and literacy apps in our sample featured hotspots—clickable spots that, when tapped, activate features like games, sounds, dictionaries, and animations.[9] Research suggests that interactive features in storybooks may not necessarily increase learning, and may in fact distract children from the educational content within the app. In a study conducted by the Joan Ganz Cooney Center (Chiong, Ree, Takeuchi, & Erickson, 2012), e-books with added interactive features were less effective than print and basic e-books in assisting parent-child co-reading because they led to more non-content related interactions (e.g., more behavior-based discussion instead of discussion of content). In a meta-analysis of research conducted on e-books, Takacs and colleagues (2015) found that general animation and sound effects within e-books were beneficial for children's story comprehension and vocabulary acquisition, but that interactive features like hotspots were distracting and detracted from learning.

A sizeable proportion of the apps in our sample—particularly those featuring puzzles, games, or quizzes—offered various forms of rewards to users. For example, completing a level might garner a new digital "sticker" for use in another section of the app. In some games, accomplishments unlocked additional levels of the game itself. In others, children were given gold stars or other visible rewards. From our perspective, rewards within educational apps may provide motivation to keep going to complete more difficult content. Furthermore, they may be a means for acquiring that more difficult content. However, McManis and Gunnewig (2012) emphasize the need to balance intrinsic versus extrinsic rewards within educational apps. Similar to Falloon's (2013) concerns about winning over learning, a child's primary focus on obtaining rewards within the app may start to overshadow her other motivations for playing with the app, such as fun and learning. Research examining how children make sense of and pursue various rewards within educational apps, and possible learning outcomes based on the nature of the rewards, is needed to inform parents' decision-making about which apps might be best for their children. Such research can also inform design elements of future educational apps.

One reason that many of the other features we looked for were infrequent among apps in this sample may be because these features require additional space and maintenance (e.g., recording,

The Children's Online Privacy Protection Act (COPPA)

The Children's Online Privacy Protection Act (COPPA), passed in 1998 with regards to websites and updated in 2013 to include apps, places restrictions on online sites that collect personal information from children under age 13. In particular, producers of these sites and Internet-capable products must seek "verifiable parent consent" before collecting information, prominently display details of what information is collected, how it is used, and whether it is shared with third-parties, and allow parents to delete children's information or revoke their consent completely. COPPA statutes are enforced by the FTC, which has recently cracked down on IT firms and app companies for violations by levying hefty fines (Reilly, 2014).

In 2014 Apple introduced its Family Plan feature, where kids under 13 can have semi-autonomous accounts under the management of a parent (Kosner, 2014). Doing so essentially shifted responsibility onto parents, who would have to approve each purchase or download that their children ask to make. It is not yet clear whether frameworks like these might encourage designers to develop more apps with features that could increase engagement but involve personally identifiable information.

For more information on COPPA, see the FTC's page of FAQs: https://www.ftc.gov/tips-advice/business-center/guidance/complying-coppa-frequently-asked-questions.

[9] When documenting hotspots, we looked for: spots on the screen that animate or make noise when touched but are secondary to main focus/game mechanics. Hotspots could be found in any type of app activity (e.g., storybooks; games; lessons/tutorials).

photo storage) or links outside the application (e.g., printing). Interestingly, looping (i.e., cycling through the app content repetitively) and the dictionary feature were not commonly found, though they are tied to known literacy strategies: repeated presentation of content and exposure to new vocabulary.

Some producers may also avoid certain features due to constraints associated with having to comply with the Children's Online Privacy Protection Act (COPPA). A 2013 update to COPPA broadened the definition of personal information to include things like photos, videos, and audio that children may upload or create through an app or site. App developers may leave out features that would collect children's personal information in order to avoid the difficulties of obtaining parents' explicit permission.

Presence of familiar characters
We also recorded whether or not each app featured a character that was well-known outside of the particular app or app series. The majority of familiar characters we encountered were from television programs or other media like movies or book series. Just over a fifth of the 170 apps (21%) in our sample contained one or more familiar characters.

Figure 15: Percent of apps that feature a familiar character

χ^2 (2, 160) = 13.5, p < .01.
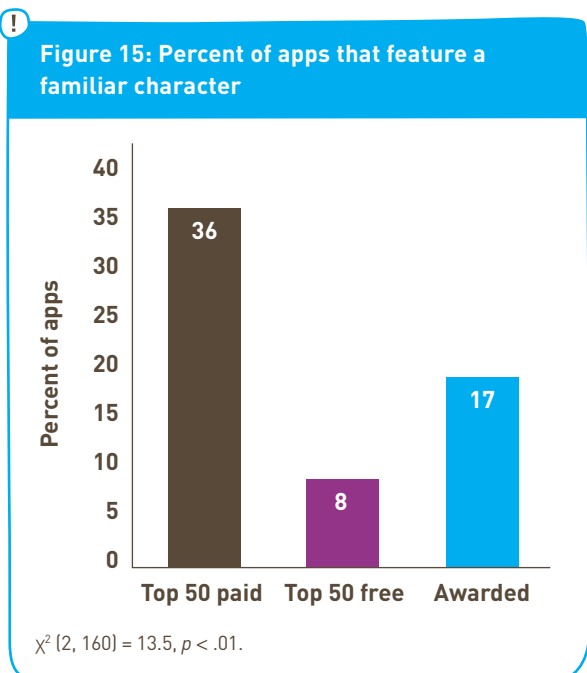
Using games thoughtfully in children's apps

Research from Sandra Calvert and others indicates that having familiar characters in an application may improve children's learning, depending on the nature of the characters and their interaction styles. The connections that children form with media characters has been dubbed "para-social relationships." These are "ongoing affective bonds with media characters" (Calvert, Richards, & Kent, 2014, p. 149). In a study conducted by Lauricella, Gola, & Calvert (2011), toddlers imitated seriation skills (e.g., sorting cups by size or color) more readily from a familiar character in a video (Elmo) compared to a novel character. The researchers reasoned that children may attend more closely to and put greater trust in on-screen characters with whom they are familiar and for whom they have developed an affinity. In media programming featuring novel characters, children may have more to process as they attempt to understand the character as well as the educational content. The authors theorized that a child's previous knowledge of either the content or character may help with reducing information processing demands (Lauricella et al., 2011).

Research further indicates that young children's increased learning from on-screen characters is most likely to occur when the character is similar to the child (e.g., in gender, favorite activities, and so on), and when its behavior is personalized (e.g., saying the child's name, speaking directly to the child; see Calvert et al., 2014). The research that exists regarding children's learning from on-screen characters has been conducted with videos; it is not yet clear how far the same principles might extend to language and literacy apps.

However, it is not clear why the rates of familiar characters in Award-winning and Top 50 Free apps are lower than in Top 50 Paid apps. This difference may signal divergent strategies for promoting apps. As mentioned above, using popular characters in app content is likely a built-in promotional benefit, as kids would be attracted to apps containing characters for whom they already have affinities. A different strategy might be to offer limited app content in a free trial app, and encourage families to pay to download more of the content. It is difficult to speculate from these data about the fairly low rate of familiar characters found in award-winning apps, but the cause of this difference is an intriguing question.

Parent-directed information

Given our interest in how parents perceive the language- and literacy-focused apps they encounter, we were curious about the extent and nature of parent-directed information provided within apps themselves. After a family downloads an app, how much information would a parent find within the app itself? For example, do most apps include information about the value of the educational content, how to use the app, or a child user's performance? Would this information be located in a place where the parent could access it anytime, display only at launch, or pop up at various intervals throughout the app content?

Location of parent-directed information within app
We first wanted to know where parent-directed information typically appeared within apps. Figure 16 indicates that more than three quarters of the apps in our sample (76%) contained sections directed explicitly to parents. Much less common was parent-directed information that popped up on-screen only when the app first launched, or appearing throughout the apps' pages or levels. A minority of apps did not contain any parent-directed information.
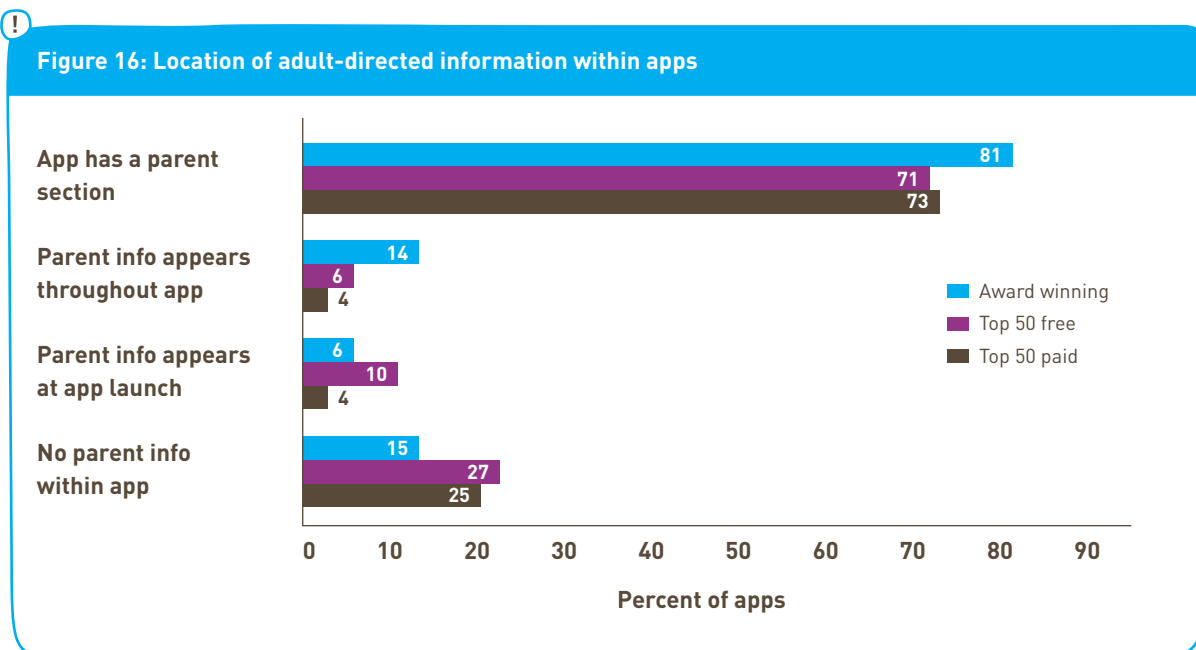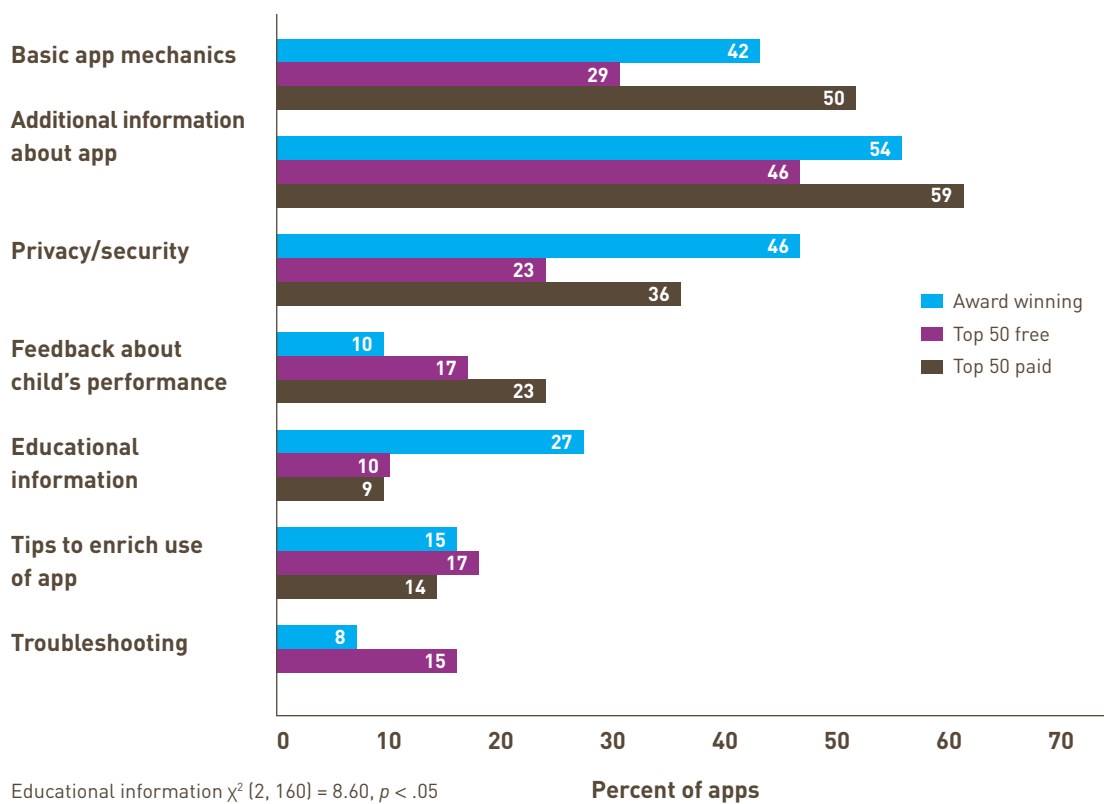

Figure 16: Location of adult-directed information within apps

	Award winning	Top 50 free	Top 50 paid
App has a parent section	81	71	73
Parent info appears throughout app	14	6	4
Parent info appears at app launch	6	10	4
No parent info within app	15	27	25

Percent of apps

Figure 17: Types of adult-directed information within apps

Basic app mechanics
- Award winning: 42
- Top 50 free: 29
- Top 50 paid: 50

Additional information about app
- Award winning: 54
- Top 50 free: 46
- Top 50 paid: 59

Privacy/security
- Award winning: 46
- Top 50 free: 23
- Top 50 paid: 36

Feedback about child's performance
- Award winning: 10
- Top 50 free: 17
- Top 50 paid: 23

Educational information
- Award winning: 27
- Top 50 free: 10
- Top 50 paid: 9

Tips to enrich use of app
- Award winning: 15
- Top 50 free: 17
- Top 50 paid: 14

Troubleshooting
- Award winning: 8
- Top 50 free: 15

Legend:
- Award winning
- Top 50 free
- Top 50 paid

X-axis: Percent of apps (0, 10, 20, 30, 40, 50, 60, 70)

Educational information χ^2 (2, 160) = 8.60, $p < .05$
Privacy/security information χ^2 (2, 160) = 6.11, $p < .05$
Troubleshooting information χ^2 (2, 160) = 9.20, $p < .05$

Nature of parent-directed information
We documented whether there was parent-directed information about children's use/performance within the app, as well as various types of additional information, such as the basic mechanics of how to use the app, additional information about the educational curriculum or value, tips for getting the most out of the app's use, privacy/security features, and how to troubleshoot problems that might occur. A final category, "additional information about the app," encompassed other types of information given about the app besides how to use it (mechanics) or educational information. Examples of "additional information about the app" included details about the development process or team, or the app's producer. We also coded for these features if the app linked to a website where the information could be found (for example, if there was a link to the company's privacy/security policy). "Additional

information about the app" was the most common type of information provided, which we encountered in more than half (55%) of apps across our sample. It was not possible to divide this into more specific categories.

Most apps included information about basic mechanics like how to use the app (40%), especially if they required parent involvement to get the child started. Often the instructions for using an app are not very obvious to a child, or the content itself needs some scaffolding. Young children may be easily frustrated if they do not understand the mechanics of an app and may click around randomly with less purpose or simply close the app and try something else (Falloon, 2013). Enabling parents to quickly find information within the app itself may allow them to change the settings or help a child understand how to use it. Very simple apps that do not focus on

literacy skills but have simple game mechanics (e.g., feed the bear, draw with paint) may not need explicit instructions.

Nearly 40% of our sample included privacy/security information. This fairly high rate is not surprising, given the Children's Online Privacy Protection Act (COPPA), which requires any app or online site that collects personal information from children under 13 to have privacy/security information available (see sidebar on p. 30). But we found it rare within our sample to find apps that provided information about a child's performance (17%), offered suggestions for how to enrich a family's use of the app (17%), gave more detailed information about the educational content specifically (14%), or offered troubleshooting pointers (8%). Additional information about educational content was most commonly encountered in Expert-awarded apps (27%), compared to Top 50 Paid (9%) or Top 50 Free apps (10%).

More than 75% of the apps that are highly promoted in app stores and by expert review sites do not allow for customizable profiles for multiple family members.

It is somewhat disconcerting to see such a lack of information provided to parents about the nature of the educational content within the app (e.g., specifics about the particular skills targeted by the app and why those skills are important to language and literacy development) as well as suggestions for how to bolster children's learning from the app. We found that apps that have been awarded by expert review sites are more likely to provide more information about educational content and privacy and security settings than those promoted as the Top Educational Paid and Free apps in stores. These may be factors that reviewers explicitly or implicitly take into account in their evaluation of children's media products. Given the higher rates of this helpful information within the apps, parents should be encouraged to consult such expert review sites when searching for apps to download.

("One size fits...some") or options and customization

Multiple accounts
Because many families might be interested in allowing more than one child play with an app we wondered how many apps made it possible for multiple children to set up their own profiles or accounts within an app, or if the app allowed for only a single user. Of our 170 apps, less than one quarter (24%) allow multiple player accounts, and we found no differences in this rate by subcategory. Thus, more than 75% of the apps that are highly promoted in app stores and by expert review sites do not allow for customizable profiles for multiple family members. In fact, we found that most apps start over at the "beginning" each time someone opens the app.

Given that so many of the apps in this sample feature puzzles, games, and quizzes, and give rewards based on a user's progress, it might be frustrating to siblings if they do not have their own profiles and accounts. Moreover, parents would be unable to track the progress of each child. These frustrations may impact many families in light of the wide age ranges that many app descriptions claim.

Customization options
We were interested in learning how many apps allowed any kind of customization, and whether any of these options might impact the educational content of these apps. We coded for the presence of options that allowed families to change an app's basic settings (such as turning music and other sounds on and off), structural features (such as the number of response options presented in quizzes, or whether storybook narration can be turned off), the level of language difficulty (such as grade level choices or "easy, medium, and hard" designations), the language in which content is presented, and the ability to choose or build avatars.

While more than 80% of the apps in our sample featured some extent of customization, we found that most options were settings that did not relate to the educational content (such as whether sound effects are turned on or off). Half of the

apps we examined did allow parents and/or users to adjust structural, educational settings of the app, such as how many response options were offered in quizzes or the time limit for puzzles. Trends suggested that these options were particularly common among Expert-awarded apps.

The most common customization options we found were for basic settings (nearly 70% of the full sample), followed by structural options (51%). The ability to choose or build an avatar (14%) and set the difficulty of the educational content ("leveling," 17%) were less common. Fewer than 20% of the apps did not offer any of the customization options we looked for.

The distribution of these various customization options based on app subsample are shown in Figure 18. We found one significant difference: apps that were among the Top 50 Free were more likely to contain leveling options, compared to Top 50 Paid and Expert-awarded apps. While Figure 18 suggests some other interesting trends, these differences did not reach statistical significance.

We were surprised to find that less than a fifth (17%) of apps allowed parents and/or children to choose a broad level of difficulty for the educational content ("leveling"). This may not be a bad thing, however. Falloon (2013) observed that 5-year-olds often opted to play continuously at the easiest level, even if their competency was clearly higher, when they realized they could set the level of difficulty within an app. They played at levels below their level of mastery in order to continue "winning."

We were also surprised to find the difference in leveling rates based on subsample, particularly since our findings suggest that parents who look specifically for free apps among the Top Educational lists in app stores are most likely to encounter apps that offer leveling options. It is difficult to speculate what that difference might mean for families. The higher rates of leveling options in Top 50 Free apps may represent a boon or a detraction for children's learning, depending on other aspects of the design and content. It is also possible that this difference reflects

Figure 18: Customization options within apps

Leveling χ^2 (2, 160) = 9.12, p <.01.

Percent of apps
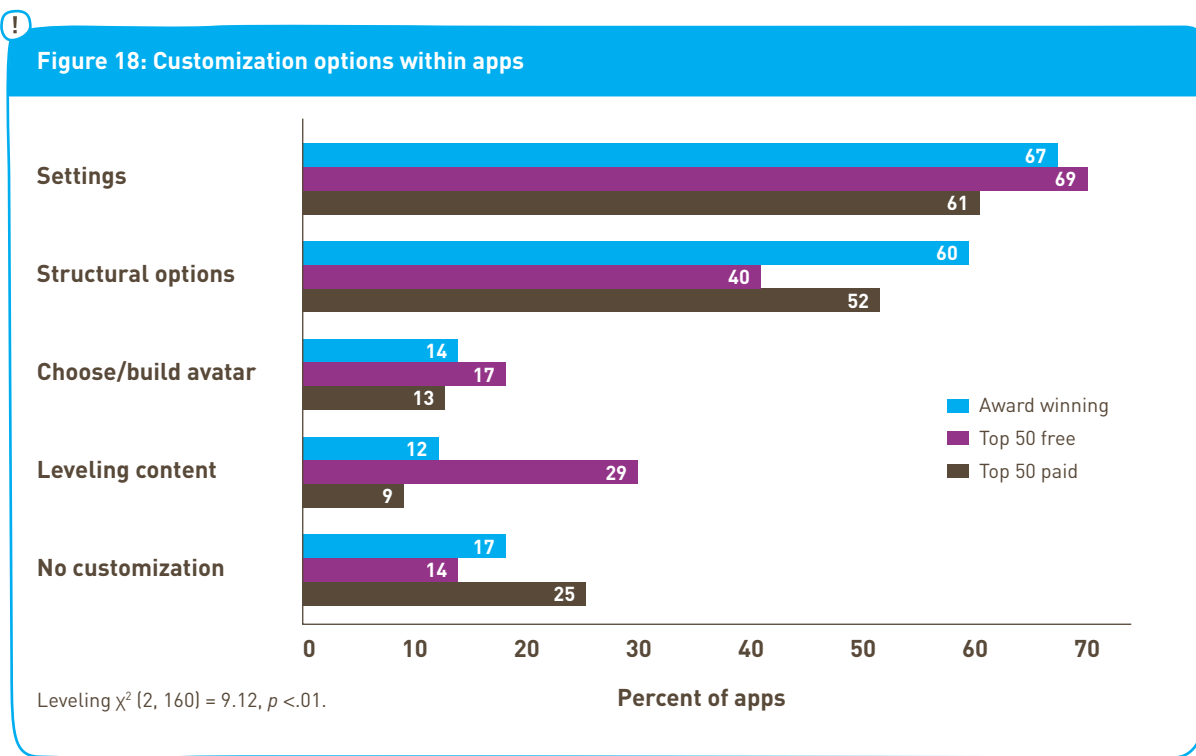
an artifact of the apps' pay structure. That is, free apps may offer leveling as a way to entice families into purchasing additional content, if some levels are outside of what is offered in the free version of the app. In these cases, the higher extent of leveling in free apps may end up leading to frustration among parents and children or even parent-child conflict over whether or not to purchase the additional levels.

Bilingual and multilingual apps

For each app in our sample we coded whether users could engage with the content in English only or in other languages too, and which other languages were available. When apps contained multiple languages, we also coded for whether the app seemed to try to teach a second language (for example, by giving translations for an English word in Spanish or vice versa), or was just available in multiple languages. In some cases it was not clear whether the app was trying to teach a second language, and so we made a third "not clear" category. We did not search stores to see if a completely separate version of the app was available in a different language; rather, these codes pertain only to whether multiple languages were found within the version of the apps we found promoted in app stores or by expert-review sites.

Figure 19: Proportions of apps that are bi- and multi-lingual

English only
73%

English and Spanish
10%

English, Spanish, and other languages
15%

English and other language(s) (No Spanish)
1%

As shown in Figure 19, nearly three-quarters of our sample (74%) contained English-only content. None of the language features varied significantly based on subsample (i.e., Top 50 Paid, Top 50 Free, and Expert-awarded).

Apps and other interactive media have particular attributes that could be leveraged for second-language learning. These media have the ability to portray multiple forms of information at the same time—such as text on-screen, audio narration of text, and images—in addition to including the same information in multiple languages (August, 2012 as cited in Vaala, 2012). What is more, some apps may be able to adapt to the child's level of proficiency and knowledge and hence tailor content, another boon for those learning a second language. This potential is especially promising given the high documented rates of cell phone and tablet ownership and use among Hispanic families in particular, including those where English is not the primary language (Rainie, 2012; Zickuhr & Smith, 2012). Many Hispanic families report strong perceptions of the educational potential of media, including apps, for their children's learning (Lee & Barron, 2015; Levinson, 2014).

We looked at the apps that did feature at least one language in addition to English, to see whether they tried to teach a second language or merely made the content accessible in multiple languages. Just over a quarter (27%) of the apps that did feature more than one language clearly included features and techniques to help children *learn* a second language. We found that a more popular feature of the bi- and multilingual apps was an option to shift the app's content from one language to another (44% of apps with more than one language). It was not clear in the remaining 29% of apps whether the app was trying support second language learning or not. Given the benefits of bilingualism, the growing number of children in the U.S. who live in households where English is not the primary language, and the obvious potential of apps for presenting information in multiple modalities and languages, this is an area ripe for further attention and development.
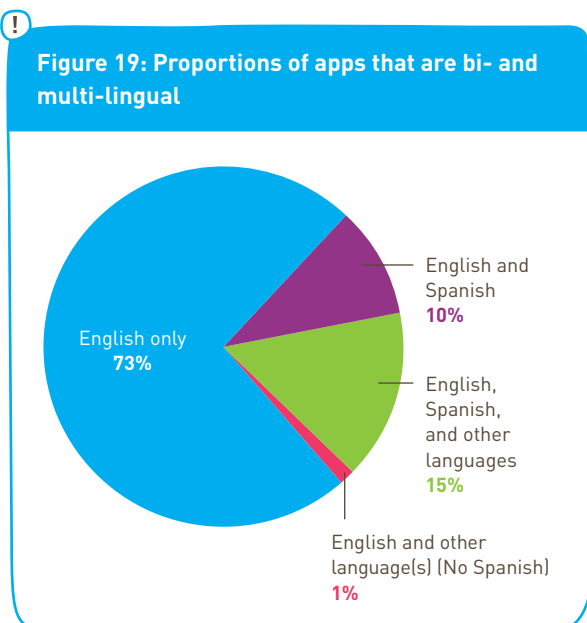
There are different ways designers and developers can support language learning. In *Apriendo en casa* (2015), Lee and Barron indicated that Hispanic-Latino parents want more information about media for their children. Moreover, educational media can catalyze conversations and activities that support learning for Hispanic-Latino children who speak Spanish or English only, or are bilingual. Lee and Barron also found high rates of joint media engagement (JME; see sidebar on p. 40) among families who speak Spanish only. than English-only families. Features to encourage this engagement with caregiver and child or with two or more children could help further JME for increased learning. Designers and developers could add information in the parent section in the parents' native language to help them figure out how to use the app with their children.

Representation of multiple races/ethnicities

We wondered whether children from various racial and ethnic backgrounds would find characters and avatars within the content of popular and expert-awarded apps that resemble themselves and their own families. As media represent an important source of socialization for children, the number and nature of characters and actors reflecting diverse backgrounds can impact children's racial/ethnic identities as well as their ideas about those from other backgrounds (Calvert et al., 2007; Clark, 2008; Cole et al., 2003; Gorn, Goldberg, & Kanungo, 1976). Research has shown that young children learn particularly well from television characters and actors that they perceive as similar to themselves (e.g., in race/ethnicity, gender, and age; Fisch & Truglio, 2000b). It is reasonable to expect that children would also benefit from seeing diverse characters portrayed in the apps they use (Clark, 2008).

Because the specific intended race or ethnicity of a character or avatar in a given app was often not clear, we recorded whether the app featured only characters of one race/ethnicity or if more than one racial/ethnic group was represented. Many apps did not have any human-like characters or avatars at all (54% of our sample). When we

Were the diverse characters present in the content upon download, or was ethnic/racial diversity dependent on the avatar chosen by a player?

found apps containing characters or avatars from more than one group we included a second level of coding: were the diverse characters present in the content upon download, or did a user have the ability to choose or upload an avatar? That is, were the diverse characters present in the content upon download, or was ethnic/racial diversity dependent on an avatar chosen by the player?

The results of these queries are displayed in Figure 20. In the majority of cases where multiple races/ethnicities were represented, these diverse characters were prominent, insofar as they were shown in the actual app content. In about a fifth of apps containing characters or avatars of multiple races/ethnicities, the diversity depended on the avatar that the child chose. The proportions of apps that featured multiple races/ethnicities did not vary significantly by subsample.

While there is room for improvement, it is promising that nearly 60% of the apps in our sample that feature human or human-like characters depict those of multiple races/ethnicities. Unfortunately, given that many of these apps featured cartoon, animated characters instead of people, we do not know which particular groups are more or less represented. Still, it seems children from at least some groups will find characters among these popular language- and literacy-focused apps with whom they might identify. Furthermore, in the majority of cases they will find these characters featured in the app's actual content, since seeing characters that are similar to themselves is not predicated on choosing an avatar of a given race/ethnicity in many cases.

A next step in this research is to document the manner in which characters of different racial/ethnic backgrounds are portrayed in children's educational apps. Our study did not examine questions like whether minority characters were

Figure 20: Percent of apps that depict multiple ethnicities

No human-like characters
54%

Only 1 ethnicity
19%

Multiple ethnicities
27%
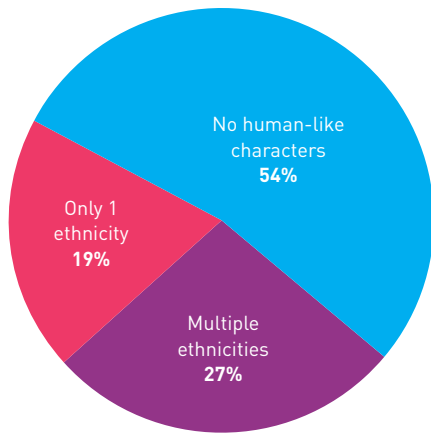
primary versus secondary characters in the apps, or whether they were portrayed in negative or stereotyped ways.

Joint media engagement design features: Social and co-use functions

The interactivity of children's apps, as well as the mobility and internet-connectivity of the devices through which they are accessed, enable users to connect and even engage jointly with others. On the other hand, individual family members often have their "own" mobile devices, small screens used by individuals on-the-go (Rideout, 2014). Many developers design apps for children's individual use.

Researchers have promoted the ability to connect with others through media or while using media together as key ways children deepen their learning (e.g., Hirsh-Pasek et al., 2015; Guernsey, 2012; Takeuchi & Stevens, 2011). In the words of Wartella (2015), "joint media engagement, and socially interactive learning more generally, offer young children an environment that can help them learn through the Vygotskian notion of scaffolding, or extending children's learning beyond what they would learn left on their own" With regard to educational apps in particular,

Hirsh-Pasek and colleagues (2015) consider social interaction to be one of the four key pillars of optimal design for children's learning (see sidebar on this page and page 39).

When designing our coding framework we conceptualized the potential for social connectivity and joint media engagement (JME) as key educational design opportunities for children's educational apps. We looked for two features in our sample: the ability to co-use the app with others such as parents or siblings, and the ability to share content from the app with others or connect socially with others some other way.

Co-use mechanics
A child could feasibly co-use any app with a parent, sibling, or peer. However, we reasoned that co-use could be more or less explicitly promoted or required through purposeful design. For example, apps that allow or require two players engaged in the same game promote JME. We looked specifically for apps in which the mechanics explicitly promoted or required co-use. Considering that co-users may not always be able to play together in real time, and that the benefits of co-use might not be dependent on real-time joint engagement, we coded both synchronous (using the app together in real-time) and asynchronous (using the app together but at different points in time) co-use mechanics.

We found only two in our sample of 170 downloaded apps that were designed with explicit co-use functions. That is, having multiple players or passing the device back and forth was explicitly part of the app's mechanics.

Sharing and connecting socially
Of further interest to us was the ability for users to share content from the app with others, such as a drawing or sticker page, one's score on a game, or a personalized message created through the app. We reasoned that the ability to connect and/or share content through the app could make it more socially relevant to users. Knowing they can share app content might push children to engage more deeply with the educational elements of the app, and connecting with others

Supporting children's learning: The "four pillars" of educational design

Hirsh-Pasek and colleagues (2015) have taken important steps in developing a rubric for evaluating the "educational" value of children's apps. The authors have identified four dimensions of apps (what they have dubbed the "four pillars") that are particularly likely to enable young children's learning, based on decades of research on how children learn from other contexts.

These four educational design principles can help guide designers in the development of children's language- and literacy-focused apps; they are a good place to begin when conceptualizing app design in the service of learning. Parents and educators can watch for these "pillars" when scouting for or using educational apps with their children. These principles can also be used by researchers and expert reviewers to classify children's apps and also help test them in efficacy studies.

The four pillars of educational app design:

1. Children should be actively *involved* ("minds on")
A wealth of research across diverse contexts indicates that children and adults alike learn best from situations in which they are actively involved. For example, acting out a scene from history could lead to deeper processing and learning than reading about the scene or hearing about it in a lecture. In the words of Hirsh-Pasek and her co-authors (2015): "apps can be designed around the affordances of mobile devices to incorporate physical activity and other experiences to spur children's minds-on engagement with app content" (p. 10).

2. Children should be *engaged* with the educational content
Learning is maximized when children are engaged with what they are doing and stay on-task, rather than diverting their attention to other distractions. This principle helps explain why hotspots that are not integral to an e-book's plotline or the point of

a game can detract from learning; they draw attention, and thus engagement, away from the educational content. Hirsh-Pasek et al. contend that incorporating content that is within a child's learning "sweetspot" (challenging, but not too hard) is one key to promoting engagement with an app. Other strategies include delivering immediate and meaningful feedback and incorporating rewards.

3. Children should experience *meaningful learning*
Learners digest and retain content more readily when they can connect it with their existing knowledge. Additionally, people engage in deeper processing when their learning is goal-driven or personally relevant. This is what it means to experience "meaningful learning." The authors suggest assessing whether an app promotes children's meaningful learning by considering "the quantity and quality of connections between the app experience and the wider circles of a child's life" (p. 15). For example, an app's content may require a child to reflect on her own personal history, consider social roles or interpersonal relationships, or activate prior knowledge of a particular subject.

4. Apps should enable children's *social interaction*
A wealth of research indicates that the presence and participation of social partners helps children—even infants—to engage with and comprehend new information. In fact, for some forms of learning, such as earliest language-learning, social interaction is required. Educational apps can employ social interaction in the service of children's learning in multiple ways. An app can require or promote co-use so that child users are interacting with caregivers, siblings, or peers while using the app. Apps can also put people in touch with each other such that they are interacting through the app (such as through video-conferencing or text messages). Finally, apps can simulate real back-and-forth interaction with on-screen characters who respond to children's actions.

could offer them additional opportunities to apply and deepen their language skills (Hirsh-Pasek et al., 2015). We coded apps as allowing sharing or connecting if they enabled users to send content or messages to others, either directly (e.g., through an in-app message, text message, or e-mail) or via social networks.

We found very few apps that allow users to connect with other people or to share content with others, through social networks, e-mail, or directly through the app. Only 11 apps in our sample (7%) enabled content sharing or social connections at all between users. These were split fairly evenly across our app subsamples. The bulk of these opportunities for social connection was through direct means, either via text, e-mail, or the app itself. Only one app enabled social connection through social networking sites, and two others had opportunities to share directly in addition to sharing through outside social networks.

While we were disappointed to see so few apps in our sample that explicitly encourage JME and social connection through their design, this is not necessarily a death knell for interacting around these apps. Parents, siblings, and others can feasibly co-use any app with a young child. Families that wish to engage together around app content can do so no matter its design, and some parents do report in recent surveys that they often co-use apps with their young children (e.g., Connell, Lauricella, & Wartella, 2015; Rideout, 2014). In a survey by the Joan Ganz Cooney Center, parent-child co-use of mobile devices accounted for 29% of time children spent overall with mobile devices (Rideout, 2014). However, some parents may not want particular features that encourage co-use and sharing. Since several of these features may require storage of a child's information, a child's work and images, and/or sharing to public spaces, privacy is a concern. Incorporating co-use and

Joint media engagement in children's apps

The notion of joint media engagement (JME) grew out of substantial research on television co-viewing, a mediation strategy by which parents view television programming alongside their children (Valkenburg et al., 1999). Co-viewing has been found to boost children's learning from educational programming, as parents have the opportunity to explain or discuss content either during or after viewing, and parents' attention also may send an implicit signal to children that the content is important and socially relevant.

In an era of laptops, motion-controlled videogames, and apps, co-viewing has been re-conceptualized in broader terms (Clark, 2011). Beyond simply co-viewing content presented on a screen, children can now *co-use* a dizzying array of media with parents, siblings, friends, and others. Often, the give-and-take of media co-use occurs in real-time, as participants pass a device back and forth to play against together, for example. Design affordances of today's technologies also allow for families and peers to jointly engage with media asynchronously, perhaps as each player takes turns in a game at the moments of the day that are most convenient for him or her, in a game such as *Words With Friends*. Similarly, several sites, including *A Story Before Bed* and Kindoma's *Storytime* allow remote family members to record themselves reading a story that children can view at a later time.

Building on a conceptualization put forth by Stevens and Penuel (2010), Takeuchi and Stevens (2011) defined JME as:

spontaneous and designed experiences of people using media together. JME can happen anywhere and at any time when there are multiple people interacting together with media. Modes of JME include viewing, playing, searching, reading, contributing, and creating, with either digital or traditional media. JME can support learning by providing resources for making sense and making meaning in a particular situation, as well as for future situations. (p. 9)

sharing features may also add extra burden on producers based on the regulations outlined by COPPA (as described above).

Still, given the documented benefits of joint media engagement and other interaction around media content for young children's learning, we feel this is a key design area that developers should focus on in future language- and literacy-promoting apps, particularly given the social nature of language in general. Encouraging and enabling parents, siblings, and other people in a child's life to engage in educational app use with him could deepen or extend his learning.

recommendations for industry, parent/educator, and research communities

Our findings indicate that a plentiful and diverse array of language- and literacy-focused apps exists for young children. Parents and educators have copious options from which to choose. However, our work paints a picture that is far from completely rosy. The most prominent language and literacy apps (by virtue of being listed among the "Top" Educational apps in stores or ranked highly by expert reviewers) are accompanied by inconsistent and often meager descriptions of their content and development, and seem to miss key teaching opportunities, such as fostering language acquisition, enabling tailored content, and promoting joint media engagement. As such, there are myriad opportunities—for producers, app stores, parents/educators, and researchers alike—to improve the process of locating appropriate apps for children and to further enhance their educational value. In this final section of our report we outline several key opportunities for different stakeholders in children's educational app use.

Opportunities for industry

1. Develop industry-wide standards for the education category
Our scan through three popular app stores revealed the lack of posted standards or processes for designating which children's apps are classified as "educational." The Joan Ganz Cooney Center has previously urged a cooperative industry-wide system for verifying the nature of apps marketed as educational (e.g., Shuler, 2007; 2012). At present it remains largely up to the developer to decide on the classification of an app. For example, in a page advising developers on how to submit apps to the App Store, Apple gives the following guidelines for classifying an app as educational:

> Apps that provide an interactive learning experience on a specific skill or subject. For example: arithmetic, alphabet, writing, early learning and special education, solar system, vocabulary, colors, language learning, standardized test prep, geography, school portals, pet training, astronomy, crafts.[10]

A lack of clear curriculum or measurable learning goals and oversight for marketing apps as educational leaves the onus on parents, teachers, and third-party review sites to separate the wheat from the chaff. A set of specific criteria for guiding an app's placement into the "educational" category could guide developers' classification of their apps and help assure consumers that they have educational value.

Moreover, providing a consistent set of information about educational apps within store descriptions would help transform the Digital Wild West into a more clearly mapped-out territory. The length of written descriptions of the apps in our sample varied from 13 to 1,089 words, a sizeable difference in the amount that an interested parent would glean about respective products. From appropriate child user age, to the particular skills targeted by the app, to various "benchmarks" of educational value: the quality of information provided varied as widely as the quantity. This lack of transparency and clarity makes it difficult for parents and educators to locate the apps that target certain skills for children in particular developmental stages, let alone weigh the rigor of educational design and testing. Those who develop and market children's educational apps would be doing families a great service by adopting a uniform way of delivering information about each app across stores.

2. Provide consumers fully transparent information about content and ranking processes
Our study findings are compelling on this point: parents and educators looking for children's educational apps would benefit from more detailed information about the apps' content and development and how apps end up on the "Top Educational" lists. Many app descriptions omit key pieces of information that could guide parents' and educators' decisions to download an app or keep searching. Perhaps a good place to start would be providing specific information about the age-range of the target user, as well as detailing the app's learning objectives and guiding curriculum or teaching philosophy.

While each app store displayed rankings of educational apps, none provided information about how those rankings were devised. Rather, why a particular app rises to the Top 50 while another does not remains shrouded in mystery. Given that many parents look to the stores to locate apps for their children, greater insight into how these lists are created would be helpful.

[10] https://developer.apple.com/app-store/product-page/

3.*Design for intergenerational use (joint media engagement)*
Young children learn best when another caring individual joins in the process. The joint participation of parents, teachers, older siblings, and even peers can heighten a child's interest in the content and scaffold their learning when the educational content is particularly challenging. Our findings suggest that few of the popular and promoted language and literacy apps for young children explicitly encourage or require co-use or content sharing. In a design-focused report about joint media engagement, Takeuchi and Stevens (2011) suggest various design strategies for encouraging co-use of digital media, including:

- **Design content that is "kid-driven"**
  Media tools are more likely to attract and maintain young users' attention if they "revolve around a child's existing interests, not just prescribed topics" (p. 45). Start with content and experiences that will intrigue children and make their interests apparent so that adults can jump in and respond to those interests.
- **Consider "multiple planes of engagement"**
  While a consideration of the child's interests and developmental abilities is paramount, it is also crucial to consider her social partner's engagement. Takeuchi and Stevens (2011) stress that not all content needs to be geared to the "lowest common denominator" of skill-level; rather, producers should consider ways to work in content that appeals to and challenges older users as well. For example, a game meant for co-play between a child and adult could incorporate more challenging content for the adult partner's turns in order to keep him or her more engaged.
- **Provide older users with "scaffolds to scaffold"**
  It is not always apparent to parents or other caregivers how to assist and expand on the educational benefits of media. To promote effective child-scaffolding, "provide guidance for the more capable partner in ways that don't require a lot of prior prep or extra time" (p. 47). One option would be to build subtle scaffolding cues right into the app's content to prompt the more advanced partner.
- **Enable "co-creation"**
  Takeuchi and Stevens (2011) contend that making something together often requires more interaction between social partners than does simply co-using or viewing content. In addition, the partners have something to share (perhaps with grandparents or siblings) and to be proud of following an episode of co-creation. Furthermore, "the literacy, technical, expressive, and collaboration skills children develop through these activities will prepare them for school and work" (p. 48).

What's a parent or educator to do?

1. Search for information about apps through different means and sources
Our data suggest that the app marketplace remains like the Digital Wild West we documented several years ago (Guernsey et al., 2012). Not only did we encounter vastly different pieces of information presented across descriptions of apps, we also found that parents and educators likely encounter completely different apps depending on how they search, either through promoted apps in the app stores themselves or via expert review sites. These findings highlight the need to do some extra legwork to identify the apps that are high quality and teach desired skills for particular ages. As such, we endorse the advice of Amy Jussel, founder of ShapingYouth.org, who urges

consumers to check several sites for information about a given app before making a decision. Over time, savvy parents or teachers will find the app review sites that have consistently recommended apps they like and can feel confident relying on these sources. She also cautions consumers to do some investigation of review sites, as many charge developers for reviews or have other undisclosed relationships with media production organizations that may cause bias (Jussel, 2015).

It may also be helpful to go beyond descriptions in the app stores and review sites by visiting developers' websites. In our study we found that checking these sites occasionally yielded information not presented in store descriptions, such as expertise on the development team and underlying curriculum behind an app.

2.Give voice to frustrations and great finds
Often, websites associated with apps and even the apps themselves contain links to developers' e-mail addresses (e.g., "contact us" links). In order to effect change in the marketplace, parents and educators should make use of these opportunities to send feedback to developers. Feedback about one's experiences with an app—either negative or positive—could help producers amend an app or make decisions about a future product.

Guidance for researchers

1. Investigate the characteristics of language- and literacy-focused apps that are most effective for teaching young children
In this report we have highlighted a number of areas where additional research could guide app development as well as parents' and educators' decision-making. In the Digital Wild West there is no shortage of opportunities to establish educational guideposts. We hope that researchers will heed these suggestions and fill in more of the gaps in our collective knowledge of what design, content, and use factors optimize children's language and literacy learning from mobile apps. A few key questions, for example, include how hotspots and other interactive features can be leveraged as learning tools instead of distractions, and whether it enhances learning to include numerous language and literacy skills in one app compared to focusing narrowly on just one or two. Other questions involve adults' experiences, including: what design elements encourage parents and other caregivers to co-use an app with a young child, and what kinds of adult-directed information would they value within the app itself?

2. Translate and share findings with developers as well as parents and educators
Unfortunately, research published in academic journal articles often lag marketplace changes, are hard for parents and developers to find, and often use technical terms and/or academic jargon. Researchers doing work in this field should make a concerted effort to translate their findings into accessible and actionable language, and share them with parent, educator, and industry audiences. Relevant research could help developers incorporate the most up-to-date best practices into the design of language- and literacy-focused children's apps to optimize learning. Widely-disseminated findings will also help parents and teachers evaluate the educational quality of the apps they encounter and to maximize their potential through proven enrichment strategies.

references

Adesope, O. O., Lavin, T., Thompson, T., & Ungerleider, C. (2010). A systematic review and meta-analysis of the cognitive correlates of bilingualism. *Review of Educational Research, 80*(2), 207–245.

Anderson, D. R. (1998). Television is not an oxymoron. *Annals of the American Academy of Political and Social Science*, 557, 24–38.

Anderson, D. R., Huston, A. C., Schmitt, K. L., Linebarger, D. L., & Wright, J. C. (2001). Early childhood television viewing and adolescent behavior: The recontact study. *Monographs of the Society for Research in Child Development, 264*(66:1).

Annie E. Casey Foundation. (2010). *Early warning! Why reading by the end of third grade matters*. A KIDS COUNT special report. Available at http://datacenter.kidscount.org/reports/reading-matters.aspx.

Barr, R., Muentener, P., Garcia, A., Fujimoto, M., & Chavez, V. (2007). The effect of repetition on imitation from television during infancy. *Developmental Psychobiology, 49*(2), 196–207.

Bialystok, E. (1999). Cognitive complexity and attentional control in the bilingual mind. *Child Development, 70*(3), 636–644.

Calvert, S. L., Richards, M. N., & Kent, C. C. (2014). Personalized interactive characters for toddlers' learning of seriation from a video presentation. *Journal of Applied Developmental Psychology, 35*, 148–155.

Calvert, S. L., Strong, B. L., Jacobs, E. L., & Conger, E. E. (2007). Interaction and participation for young Hispanic and Caucasian girls' and boys' learning of media content. *Media Psychology, 9*, 431–445.

Calvert, S. L., & Wilson, B. J. (Eds.). (2009). *The handbook of children, media and development*. Hoboken, NJ: John Wiley & Sons.

Campbell, M. (2013, August 13). Apple asks developers to classify apps by age range for new "Kids" App Store category. *Apple Insider*. Retrieved from http://appleinsider.com/articles/13/08/17/apple-asks-developers-to-classify-apps-by-age-range-for-new-kids-app-store-category.

Chen, C. M. (2008). Intelligent web-based learning system with personalized learning path guidance. *Computers & Education, 51*(2), 787–814.

Chiong, C., Ree, J., Takeuchi, L., & Erickson, I. (2012, Spring). *Comparing parent-child co-reading on print, basic, and enhanced e-book platforms*. A Joan Ganz Cooney Center Quickreport. New York: Joan Ganz Cooney Center at Sesame Workshop.

Clark, K. (2008). Educational settings and the use of technology to promote the multicultural development of children. *Handbook of Child Development, Multiculturalism, and Media*. Newbury Park, CA: Sage.

Clark, L. S. (2011). Parental mediation theory for the digital age. *Communication Theory, 21*, 323–343.

Cole, C., Arafat, C., Tidhar, C., Tafesh, W. Z., Fox, N., Killen, M., & Richman, B. (2003). The educational impact of Rechov Sumsum/Shara'a simsim: A Sesame Street television series to promote respect and understanding among children living in Israel, the West Bank, and Gaza. *International Journal of Behavioral Development, 27*(5), 409–422.

Common Sense Media. (2015, Fall). *The Common Sense census: Media use by tweens and teens*. San Francisco, CA: author.

Common Sense Media. (2013, Fall). *Zero to Eight: Children's media use in America 2013*. San Francisco, CA: author.

Connell, S. L., Lauricella, A. R., & Wartella, E. (2015). Parental co-use of media technology with their young children in the USA. *Journal of Children and Media, 9*(1), 5–21.

Crawley, A. M., Anderson, D. R., Wilder, A., Williams, M., & Santomero, A. (1999). Effects of repeated exposures to a single episode of the television program Blue's Clues on the viewing behaviors and comprehension of preschool children. *Journal of Educational Psychology, 19*(4), 630–637.

Elmer-DeWitt, P. (2014, June 27). Apple's users spend 4X as much as Google's. *Fortune*. Retrieved from http://fortune.com/2014/06/27/apples-users-spend-4x-as-much-as-googles/.

Falloon, G. (2013). Young students using iPads: App design and content influences on their learning pathways. *Computers & Education, 68*, 505–521.

Federal Trade Commission. (2012, February). *Mobile apps for kids: Current privacy disclosures are disappointing*. Washington, DC: author.

Fisch, S. M. (2000). A capacity model of children's comprehension of educational content on television. *Media Psychology, 2*(1), 63–91.

Fisch, S. M. & Truglio, R. T. (2000a). *G is for growing: 30 years of research on Sesame Street*. New York: Lea's Communications Series.

Fisch, S. M., & Truglio, R. T. (2000b). Why children learn from Sesame Street. In S. M. Fisch & R .T. Truglio (Eds.) *G is for growing: Thirty years of research on children and Sesame Street* (pp. 233–244). Mahwah, NJ: Lawrence Erlbaum Associates.

Gorn, G. J., Goldberg, M. E., & Kanungo, R. N. (1976). The role of educational television in changing the intergroup attitudes of children. *Child Development, 47*(1), 277–280.

Guernsey, L. (2012). *Screen Time: How Electronic Media—From Baby Videos to Educational Software—Affects Your Young Child*. New York: Basic Books.

Guernsey, L. & Levine, M. (2015). *Tap, click, read: Growing readers in a world of screens*. San Francisco, CA: Jossey-Bass.

Guernsey, L., Levine, M., Chiong, C., & Severns, M. (2012). *Pioneering literacy in the digital wild west: Empowering parents and educators*. New York: The Joan Ganz Cooney Center at Sesame Workshop.

Hirsh-Pasek, K., Zosh, J. M., Golinkoff, R. M., Gray, J. H., Robb, M. B., & Kaufman, J. (2015). Putting education in "educational" apps: Lessons from the science of learning. *Psychological Science in the Public Interest, 16*(1), 3–34.

Huang, Y. M., Liang, T. H., Su, Y. N., & Chen, N. S. (2012). Empowering personalized learning with an interactive e-book learning system for elementary school students. *Educational Technology Research and Development, 60*(4), 703–722.

Institute of Education Sciences, National Center for Education Statistics. (2015, May). *The condition of education: English language learners*. Retrieved from http://nces.ed.gov/programs/coe/indicator_cgf.asp.

Jussel, A. (2015, August 4). Children's app reviews: Does money talk? [Blog post] ShapingYouth.org. Retrieved from http://www.shapingyouth.org/childrens-app-reviews-money-talks/.

Katz, V. S. & Levine, M. H. (2015) *Connecting to learn: Promoting digital equity among America's Hispanic families*. New York: The Joan Ganz Cooney Center at Sesame Workshop.

Kosner, A. W. (2014, June 14). Apple's new family plan makes it easy to solve the iTunes identity crisis. *Forbes*. Retrieved from http://www.forbes.com/sites/anthonykosner/2014/06/14/apples-new-family-plan-makes-it-easy-to-solve-the-itunes-identity-crisis/.

Lauricella, A. R., Barr, R., & Calvert, S.L. (2014). Parent-child interactions during traditional and computer storybook reading for children's comprehension: Implications for electronic story-book design. *International Journal of Child-Computer Interaction, 2*, 17–25.

Lauricella, A. R., Gola, A. A. H., & Calvert, S. L. (2011). Toddlers' learning from socially meaningful video characters. *Media Psychology, 14*, 216–232.

Leikin, M. & Tovli, E. (2014). Bilingualism and creativity in early childhood. *Creativity Research Journal, 26*(4), 411–417.

Linebarger, D. L. & Walker, D. (2005). Infants' and toddlers' television viewing and language outcomes. *American Behavioral Scientist, 48*(5), 624–645.

Ly, A. K. (2014, September 8). *Inside Kiko Labs: Part I of a case study*. gamesandlearning.org. Retrieved from http://www.gamesandlearning.org/2014/09/08/kiko-labs-chapter-1-the-creative-beginnings-draft/.

McManis, L. D. & Gunnewig, S. B. (2012, May). Finding the education in educational technology with early learners. *Young Children, 67*(3), 14–24.

National Association of Young Children. (1998). *Learning to read and write: Developmentally appropriate practices for young children.* Washington, DC: author. Retrieved from http://www.naeyc.org/files/naeyc/file/positions/PSREAD98.pdf.

National Institute for Literacy. (2009). Early beginnings: Early literacy knowledge and instruction. http://www.nichd.nih.gov/publications/pubs/documents/NELPEarlyBeginnings09.pdf.

NPD Group (2012). *Kids and apps: A new era of play.* Port Washington, NY: author.

Rainie, L. (2012, January). Tablet and e-book reader ownership nearly double over the holiday gift giving period. Washington, DC: Pew Internet & American Life Project.

Reilly, R. B. (2014, September 17). Feds officially kick off campaign to nail COPPA violators. Here's why you should care. *VentureBeat.* Retrieved from http://venturebeat.com/2014/09/17/feds-officially-kick-off-campaign-to-nail-coppa-violators-heres-why-you-should-care/.

Rideout, V. J. (2014, January). *Learning at home: Families' educational media use in America.* A report of the Families and Media Project. New York: Joan Ganz Cooney Center at Sesame Workshop.

Shuler, C. (2007). *D is for digital: An analysis of the children's interactive media environment with a focus on mass marketed products that promote learning.* New York: The Joan Ganz Cooney Center at Sesame Workshop. Retrieved from http://www.joanganzcooneycenter.org/wp-content/uploads/2009/03/disfordigital_reports.pdf.

Shuler, C. (2012) *iLearn II: An analysis of the education category of the iTunes app store.* New York: The Joan Ganz Cooney Center at Sesame Workshop.

Stevens, R. & Penuel, W. R. (2010). Studying and fostering learning through joint media engagement. Paper presented at the Principal Investigators Meeting of the National Science Foundation's Science of Learning Centers, Arlington, VA.

Takacs, Z. K., Swart, E. K., & Bus, A. (2015). Benefits and pitfalls of multimedia and interactive features in technology-enhanced storybooks: A meta-analysis. *Review of Educational Research.* doi:0034654314566989.

Takeuchi, L., & Stevens, R. (2011, December). *The new coviewing: Designing for learning through joint media engagement.* New York: The Joan Ganz Cooney Center at Sesame Workshop.

U.S. Department of Education. (1998, February). *Checkpoints for progress in reading and writing for families and communities.* Washington, DC: author. Retrieved from http://www2.ed.gov/pubs/CheckFamilies/index.html.

Vaala, S. E. (2012, Spring). *Aprendiendo Juntos (Learning together): Synthesis of a cross-sectional convening on Hispanic-Latino families and digital technologies.* New York: Joan Ganz Cooney Center at Sesame Workshop.

Vaala, S. E., Linebarger, D. L., Fenstermacher, S. K., Tedone, A., Brey, E., Barr, R., Moses, A., Shwery, C. E., & Calvert, S. L. (2010). Content analysis of language-promoting teaching strategies used in infant-directed media. *Infant and Child Development, 19*(6), 628–648.

Valkenburg, P. M., Krcmar, M., Peeters, A. L., & Marseille, N. M. (1999). Developing a scale to assess three styles of television mediation: "Instructive mediation," "restrictive mediation," and "social coviewing." *Journal of Broadcasting and Electronic Media, 43*(1), 52–66.

Wartella, E. (2015). Educational apps: What we do and do not know. *Psychological Science in the Public Interest, 16*(1), 1–2.

Waters, J. K. (2014, May 14). Adaptive learning: Are we there yet? *THE Journal.* From https://thejournal.com/Articles/2014/05/14/Adaptive-Learning-Are-We-There-Yet.aspx?Page=1.

Wilder, A. A. (1996). *Challenging the active minds of children: Blue's Clues curriculum guide.* New York: Nickelodeon.

Zickuhr, K. & Smith, A. (2012, April). *Digital differences.* Washington, DC: Pew Internet & American Life Project.

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