An Investigation of Protagonists in Storybook Apps for Children

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─────────── **Abstract** ───────────

Children's literature has historically been rife with implicit biases and underlying themes, and few scholars have investigated the impact technology has had on those elements appearing in children's literature. In response, this study used a content analysis methodology to evaluate 38 storybook applications (apps) for containing implicit biases and underlying messages related to the narrative's protagonists. These storybook apps were designed for young children to engage on their iPads. Overall, the study found that the storybooks apps predominantly featured protagonists who were White, middle-class, able-bodied males. The researchers first provide their rationale for the study along with their theoretical framework before describing their methodology and findings. The researchers conclude with implications for teacher educators, preservice and in-service teachers, storybook authors and app developers, and future researchers.

Keywords: *Children's literature, storybooks, apps, implicit bias, content analysis*

It is well known that children's early experiences with books, text, and language lay the foundation needed for academic success. Saracho (2007) explained that early reading experiences establish the foundation of later reading success by preparing children for formal literacy instruction. Sparks et al. (2014) found that providing children with opportunities to encounter new words and spoken language in texts supports their reading development by building their background knowledge about diverse topics. Gambrell (2015) reported that positive early reading experiences can hook children into being readers for life. These scholars saw value in children's literature—a genre of literature for young readers that includes folk tales, bedtime stories, poetry, informational books, biographies, and other texts—as being an academic development. However, consideration

must be extended to the content children are reading, because scholars have long identified that children learn about the world through their early reading experiences (Berry & Wilkins, 2017; Woolley et al., 2004). With early reading experiences being formative to young children, this study's purpose is to continue the tradition of analyzing children's literature; however, it shifts focus from paper-based literature in the form of books to digitized storybook texts designed for mobile devices.

Like in other areas, technology's impact on children's literature is remarkable. Once a completely paper-based industry, children's literature now takes the form of eBooks in the mode of applications (apps) that can be downloaded onto mobile devices, which has revolutionized early reading experiences for children. Ciampa (2016) explained that these apps allow young children to interact with texts in ways that were not previously possible, such as apps narrating stories to readers, using music and animation to engage readers, and including games and activities in their interface. In turn, these functionalities can motivate children to read. However, even with these advanced functionalities, the content of children's literature in the form of apps still needs to be analyzed for its underlying themes and implicit biases even more than paper-based versions because of the ways these apps can be authored and developed.

Unlike authors working with publishers to create paper-based children's literature as they did prior to the popularization of digital technologies, authors can now work directly with developers to create their own storybook app and make it available for download. As a subset of children's literature, storybooks provide a narrative that reflects cultural values through language usage, descriptions of characters and events, and customs reflected in the text (Tsai et al., 2007). With storybooks, it is essential that their representations are accurate; however, with app developers themselves being able to author storybooks, there is little oversight about the storybook's content before it is published and available for download.

Although the choices publishers have made about the content of children books that they have printed is certainly not without critique—meaning that racism, gender issues, and negative stereotypes have been found in children's literature after it has been published (Koss, 2015; Nel, 2017; Tsao, 2008)—publishers have nevertheless provided editorial feedback and perspective about the content in the books. However, with storybook apps, developers are able to publish, upload, and tag them directly into app marketplaces (e.g., App Store, Google Play) without ever having to work with an author or publisher. The result is that there is little to no oversight of an app's content nor the credentials of the person who wrote it, only that the app meets the minimum criteria needed to be downloaded and run on a mobile device. Given that context, this study used a content analysis technique to make sense of the underlying themes and implicit bias in children's literature published as iOS apps, and it asked the following questions:

1.   What is the protagonist's socioeconomic status?

2.   What is the protagonist's race?

3.   What is the protagonist's gender?

4.   Is the protagonist able-bodied?

Based on these questions, this study's goal was twofold. First, it was to identify how the central figure of children's literature in the form of storybook apps is represented. This first goal is significant because as the world grows more diverse, it is important that children see themselves in the literature they are reading and learn about other groups of people;

researchers have found children are more engaged and develop higher literacy rates when that happens (Bishop, 1990a; Landt, 2006; Moss, 2015). It is therefore important to see if this trend exists in storybooks published as apps. Second, this research was intended to demonstrate a technique for conducting a content analysis on digital texts. As apps continue to become more popular and more emphasis on implicit biases in technology is given (Noble, 2018), researchers need evolving methodologies to analyze digital texts, and this study models one such way.

To frame this article, we first provide an overview of research focused on children's literature in both paper-based and digitized versions before sharing the theoretical framework that guided this study. Next, we describe our methodology and findings before concluding with implications and recommendations for teacher educators, preservice and in-service teachers, authors and developers of storybook apps, and future researchers.

The Power of Children's Literature

The richness of children's literature should not be discounted. In fact, when reading children's literature with a critical lens, readers may come to see their own values, biases, and identities reflected in it (Laminack & Kelly, 2019). In her work, Bishop (1990a) introduced a metaphor that positions children's literature as mirrors, windows, and sliding glass doors. Children's literature is a mirror when young readers are able to see themselves reflected in the characters who exist in it, and these readers and characters often have majoritarian traits. Conversely, children's literature becomes a window when young readers have the opportunity to learn about other groups of people who exist in the world. As a window, Bishop explained that children's literature gives young readers who live in largely homogenous contexts a way to meet people from different places and learn about their customs, religions, traditions, and other cultural markers. When opportunities to learn about these different groups are taken, children's literature becomes a sliding glass door that allows young readers to have these experiences. It is important that young readers have these experiences because culturally relevant pieces of children's literature support the development of young readers' background knowledge as well as their reading comprehension and meaning-making skills (Ebe, 2010). However, as Bishop pointed out, children's literature that offers these opportunities is the exception, as shown by the Children's Cooperative Book Center (2021).

Supported by the University of Wisconsin's School of Education, the Children's Cooperative Book Center (2021) tracks children's books based on the race/ethnicity demographics of their authors and the representation of cultures in them. The Center has been monitoring these books since 1985, and it has evolved its tracking from originally focusing on books authored by Black authors to now including books that are authored by and about cultures including Blacks/Africans, Indigenous peoples, Asians, Latinx, Pacific Islanders, and Arabs. These data are important because they demonstrate the mirrors and windows that Bishop (1990a) described; Table 1 shows a snapshot of this data.

Table 1

Data about the author and focus of children's books from 2018–2019

Year	# of books analyzed	Black/African		Indigenous		Asian		Latinx		Pacific Islander	
		by	About	by	About	by	About	by	About	by	About
2019	4,035	232	471	46	65	429	357	243	236	5	5
2019	3,682	214	405	43	56	393	344	207	252	2	7

Source: Children's Cooperative Book Center (2021).

  The data show that the vast majority of children's books are written by White authors or are about White culture. For example, of the 3,682 children's books analyzed in 2018, 859 (23.3%) were written by non-White authors, and 1,064 (28.8%) were about non-White culture. In 2019, of the 4,035 books analyzed, 955 (23.6%) were written by non-White authors, and 1,134 (28.1%) were about non-White culture. These data demonstrate that White children are very likely to be looking into mirrors when reading children's literature, with limited opportunities to peer through windows into other cultures. Conversely, young readers of color are much more likely to be looking through windows when engaging children's literature. Other researchers have conducted studies that confirm these findings (Bishop, 1990b; Kelly et al., 2020; Moller, 2016; Sharma & Christ, 2017; Tatum, 2000). In response, researchers have developed questions to support the analysis of children's literature.

  Laminack and Kelly (2019) developed a set of questions that extend Bishop's (1990a) metaphor by supporting teachers in applying a critical lens to children's literature with regard to their own context. Due to language and power influencing and shaping the world (Freire, 2000), Laminack and Kelly's questions aim for teachers to examine the cultures, identities, and voices that are and are not included in children's literature, which helps teachers determine a text's cultural relevance. Here are some examples of their questions in relation to this study:

1. Does the book portray culture accurately and without perpetuated stereotypes?
2. Is the reader the same age and gender as the main character?
3. Does the reader talk in similar ways to the main character?
4. Does the reader live in a place similar to the setting of the book?

Asking such questions enacts a critical lens in teachers through reflection and critical analysis. In addition, Kelly et al. (2020) found that preservice teachers are in a position to advocate for diversity and inclusivity in their instructional context by asking these questions.

  Sharma and Christ (2017) stated that integrating students' cultural knowledge and ways of being in the world supports student learning and is a form of culturally responsive pedagogy. Students' social histories, cultures, and contexts matter in literacy development because they empower students' social, emotional, and intellectual development (Gadsden,

1993; Ladson-Billings, 1994). Furthermore, culturally relevant texts improve students' literacy outcomes by anchoring their identities, experiences, and norms in the texts and society (Gray, 2009). Children's meaning-making process is then developed when the text is compatible with their background knowledge specific to a cultural context (Ebe, 2010). Whether they are reading about their own cultural or another one, young readers are building background knowledge about diverse groups of people, which helps them better understand the world and people in it. In fact, Moller (2016) emphasized that for characters to be authentically represented, the text must include the characters' values, attitudes, distinctive language patterns, and other cultural markers. To integrate equity into literacy development, it is critical that students of color are able to see themselves in the literature they are reading and that majority students are able to expand their understanding of the world through authentic representation (Bishop, 1990a; Lazar et al., 2012). Taking those steps addresses the biases identified in children's literature.

Bias can be reflected in stereotypical portrayals of characters in children's literature. Adichie (2009) explained that stereotypes paint an incomplete and one-dimensional picture of a person, profession, race, ethnicity, or country. In their study, as an example, Sandefur and Moore (2004) analyzed 96 pictures of teachers taken from 62 children's books to understand how the teachers were portrayed, and they found "bias, prejudice, and stereotypical presentations of characters in [those] children's books" (p. 50). By analyzing the teachers' physical appearance, language usage, subject matter, instructional approach, and overall effectiveness, they identified that teachers were commonly depicted as White women from non-Hispanic backgrounds who do not display caring dispositions or organized classrooms. In addition, the teachers are positioned as uninspiring authority figures in the classroom. To that end, Sandefur and Moore recommended that representing teachers in a positive light can better support children, parents, teachers, administrators, and communities working together. Books that represent teachers in a negative light contribute to potential biases children may have toward teachers before they even begin school, and those contributions are not limited to only characters but extend to other themes as well. However, there are several examples of children's literature that build young reader's cultural literacies (Gray, 2009; Sharma & Christ, 2017).

In Pratt et al.'s (2021) analysis of the 2011–2015 Pura Belpré Award, they identified positive representations of Latinx culture. This award is dedicated and named after the first Latina librarian to work in New York City and is given to Latinx authors and illustrators whose children's books best celebrate, portray, and honor Latinx culture (Association of Library Service for Children, 2021). In their study, Pratt et al. identified two prominent themes in the 16 awarding-winning pieces of children's literature they analyzed: interdependence and resourcefulness. Pratt et al. explained that interdependence was expressed when children, parents, and grandparents each had leading and supporting roles in their homes and communities, with emphasis placed on the characters relying on one another throughout the narratives. This interdependence demonstrates the importance that each role has in the Latinx culture, and it is directly connected to the second theme of resourcefulness.

For their second theme, Pratt et al. (2021) defined resourcefulness as characters and communities that use their physical and intellectual abilities as well as their social assets to support other family or community members. For example, Pratt et al. highlighted one protagonist who could have been isolated but instead learned to use the public transportation system to navigate a city. In another example, they described a community that was forced into hiding, but then its members developed dances and songs about their

lives, which they eventually performed at different establishments to earn revenue and share their culture with the broader community. In these ways, Pratt et al. highlighted the assets of characters, as opposed to the deficits that Sandefur and Moore (2004) found in their analysis of teachers.

Although researchers have identified the existence of biases in children's literature and the importance of critically analyzing them, Pratt et al.'s (2021) examples show that children's literature is also able to portray cultures from positive, asset-based perspectives. Because children's literature has the power to represent cultures positively, negatively, and in combinatory ways, it is essential to continue this line of research as children's literature becomes more widely available in the form of storybook apps.

A Review of Research Focused on Children's Storybook Apps

Storybook apps are not a new type of technology or text to study. In preparation for this study, we searched Google Scholar, ERIC, and a major university's library using keyword combinations of *storybook, apps, content analysis,* and *children's literature* to locate previous works focused on storybooks. We found only one content analysis on storybooks apps, but its focus was on the availability of those apps in different languages, the quality of the storybook, and their accessibility based on cost and where they can be downloaded (Bus et al., 2019). None of the studies we found focused on underlying themes or implicit messages in storybook apps. Rather, they focused on reader engagement, reading abilities, and reader interaction with the text.

For reader engagement, Noorhidawati et al. (2015) studied the ways eight preschoolers used eBooks, which included storybook apps. They collected survey responses from the preschoolers' parents about their children's backgrounds along with their use of paper-based books and digital apps in the home. The researchers then observed and noted how the children engaged the different apps for 410 minutes independent of adults. They then qualitatively analyzed the data. They found that the children learned in three ways. First, they learned cognitively, as shown by their comprehension of the apps' content and completion of their activities. Next, the children demonstrated psychomotor growth based on them being able to manipulate the apps' content from their screen. Finally, affective learning was found in how the children responded to the stimuli in the apps (e.g., smiling at the screen, interacting with the device). Overall, Noorhidawati et al. found that the preschoolers learned from apps without adults in informal settings.

Zipke (2017) investigated the impact of storybook apps on 25 preschoolers' reading abilities. Zipke first focused on word recognition and had the preschoolers transact with a storybook app by using its read-aloud function as compared to them listening to a teacher read the book. After testing, Zipke linked a small increase in word recognition to the storybook apps, as compared to the teacher's reading. Next, she had the preschoolers engage storybook apps twice, once with a partner and then in a guided procedure with an adult who asked questions about the text. When students engaged with a partner as compared to an adult, Zipke found they had higher rates of comprehension. Also notable is that when she asked them their preference for reading a paper-based storybook or a digital one and if they preferred reading with a partner or with an adult, the preschoolers overwhelmingly chose reading a storybook app without an adult. Zipke referred to these finding as unexpected, given that her hypothesis was that an adult guide who posed questions would provide a better scaffold than an app. In this way, Zipke's study adds validity to Noorhidawati et al. (2015) because she also found that young children can learn independently using apps.

Finally, Aliagas and Margallo (2017) analyzed the interaction of children with the features (e.g., buttons, games, activities) embedded in storybook apps. Specifically, the researchers were interested in the ways students would respond to the interactive features of an app. The researchers video recorded the children—ages 18 months to 5 years from four different families—engaging storybook apps on their iPad on two to three separate occasions per child; each occasion lasted 2–3 hours. The researchers analyzed the data by first contextualizing the storybooks' plot based on narrative elements (e.g., plot, structure), and they documented the apps' interactive features. They then analyzed how the children interacted with the apps' narrative and features as well as the features' interactive elements that trigger engagement. The researchers found that the apps' features worked to reposition the child from the role of a reader to a "storyteller, author or internal character" (p. 51). For example, one child used the navigation features in the app to advance the narrative to the parts that included favorited characters. Another child used the interactive "theatre" feature to design her own scene using the storybook's settings, characters, and props to create her own narrative. Repositioning the child from a reader into one of the other roles resulted in them becoming more active readers than if they were to read a paper-based storybook, which represents a new role for how individuals transact with texts. Aliagas and Margallo's study breaks with analyzing the engagement levels of young children with storybook apps and instead focuses on the content of those stories. Due to how children engage these apps, it shifts them from being passive readers to actively transacting with the text.

Taken together, the studies summarized in this section show how researchers have recently been analyzing storybooks. They have examined the preference of reading stories in the form of apps as compared to paper-based books and investigated the impact storybook apps have on children's reading abilities and engagement. Our study addressed the actual content of storybook apps to understand their underlying themes or potential implicit biases.

Using Text Transaction as a Guiding Framework

This study is guided by Rosenblatt's (1988) theory of text transaction. Rosenblatt explained that "every reading act is an event, a transaction involving a particular reader and a particular configuration of marks on a page, and occurring at a particular time in a particular context" (p. 4). In this quote, Rosenblatt identified a person as a particular reader and the "marks on a page" being a text. In this view, meaning is not held in the text; rather, it is the moment when the reader transacts with the text. The word transacts is purposeful in that readers negotiate the meaning of a text based on their background knowledge, past experiences, and connotations in relation to the content presented to them from the text. From that perspective, text is understood as any artifact that can be interpreted for meaning (Cochrane, 2013). Further, as readers mature and sociopolitical ideologies shift, these changes inform the transaction readers have with a text. Therefore, the context—including the time, location, and culture of a society as well as the mindset of the reader—must be considered because sociocultural norms and people change, and Margalit's (2014) op-ed piece of Shel Silverstein's *The Giving Tree* exemplifies this point.

In her piece, Margalit (2014) shared that she came by an old copy of The Giving Tree as an adult, and

> instead of experiencing a pleasant rush of nostalgia, I was dismayed. A strange thing happens when we encounter a book we used to love and suddenly find it charmless; the feeling is one of puzzled dissociation. Was it really me who once cherished this book? (para. 1)

Margalit identifies her change of view regarding the book as "a kind of scientific proof that I'd grown up and changed" (para. 14). As she matured, gained world experience, and learned about Shel Silverstein as a person, it changed how she understood the text. For Rosenblatt's theory, the ways individuals transact with text is not finite, concrete, or binding. Rather, they change, as was the case with Margalit and The Giving Tree. For this study, Rosenblatt's theory of text transaction was appropriate because it recognized that the researchers could interpret the app differently from young readers and each other.

When transacting with the storybook apps, we were mindful that our own positionalities and intersectionalities informed how we came to understand the texts. For example, Todd transacted with the apps based on his background of being raised in a White, middle-class household with parents who read paper-based children's stories to him most nights during his childhood. He brought those memories and experiences with him while reviewing the apps. Nandita, on the other hand, grew up in an Indian, middle-class household with the oral storytelling tradition, and her grandmother told her stories as part of their daily routine. During her review, these formative experiences informed the ways that she transacted with the apps. Rosenblatt's theory contends that there are no right or wrong interpretation of the text; instead, it recognizes that we transact with texts based on multiple factors that are unique to each of us. Furthermore, the theory helped to address the misalignment between the storybook apps' intended audience of children and we, the researchers, being middle-aged adults.

The apps analyzed in this study were designed for young readers with fewer life experiences; however, we are academics who work, teach, and research at colleges of education and bring with us background knowledge and past experiences that are not expected of the apps' intended audience. Using text transaction as a framework allowed us to filter the apps' content against our own selfness to identify themes and messages in the apps that may have gone previously undetected. In this way, text transaction offered a flexible framework for conceptualizing our interpretations of the apps' content and presenting them as findings.

Methodology

This study's purpose was to analyze the underlying themes and implicit messages contained in storybook apps, as related to the protagonists. To increase credibility, this study used a systematic process for collecting and analyzing data from the apps. This section explains how data were collected and evaluated using a content analysis approach (Zhang & Wildemuth, 2009).

Data Collection

To find the storybook apps, we used the Google search engine. Because Google is the most used search engine in the world, we agreed to use it for this study, though it is not without critique (Noble, 2018). We saw value in Google because it would be an accessible resource for future researchers who may wish to replicate our study. Concurrently, we are aware that Google's algorithm is embedded with the implicit bias of its developers, which could alter the results it provides (O'Neil, 2016). To locate the apps, we entered the term "storybook apps" into Google, and it reported a limited number of apps, but it also reported several blogs that recommended storybook apps and often included links to download them. We therefore chose to use these blogs for identifying apps, as long as they met certain criteria.

For this study, we agreed to exclude all aggregate apps, which we defined as apps containing more than one story, such as apps that function as reading programs (e.g., ABC

Mouse) and book libraries (e.g., Epic!). Because aggregate apps contain several dozen stories, it was not possible to include them in this sample. Second, for an app to be included, it had to feature a single narrative that was rated for ages 4 and up and was not a fairy tale or fable. Concept apps that only described shapes, colors, and words for children 3 and under were excluded. Apps that were fairy tales and fables were also excluded because this study was interested in contemporary stories that were authored specifically to be an app, not a cultural artifact or allegory. Third, the apps had to be free or follow a freemium model that gave access to the app's story. This decision was made so the apps' accessibility would not be determined by cost. Fourth, the apps had to be formatted as iOS apps that could be downloaded from the North American App Store. These criteria helped narrow the number of apps, and they set specific parameters for locating the apps sought for this study. In all, we originally identified 112 apps and finally settled on 38 for this study (see Appendix A for the full list). The major reason apps were excluded was that they were a fairy tale or fable or they were not available for download in North America. We next employed a well-regarded approach for conducting our content analysis.

Data Analysis Procedures

Storybook apps contain combinations of lettered texts, images, and animations to tell a narrative. To analyze these apps, we used a content analysis technique (Hsieh & Shannon, 2005) that we selected because it provided a qualitative method for focusing on the use of language in the text along with specific attention to its content and contextual meaning. Because the apps analyzed in this study are a combination of text and language being used to communicate a story that contains images and digital effects (content) within a setting (context), content analysis provided a systematic way to evaluate the multimodalities integrated within the apps, and we adopted procedures to help ensure the fidelity of our analysis.

Zhang and Wildemuth (2009) offer eight steps to complete a content analysis; Table 2 lists each step along with the way it was applied to this study.

Table 2

Zhang and Wildemuth's (2009) Steps for Conducting a Content Analysis

Step	Application
1. *Prepare the data.* Convert the data to written text needed for the analysis.	The apps largely were already in a text-based format. A chart was created to organize the data, and it included links for downloading the apps.
2. *Define the unit of analysis.* Identify the criteria that constitute a unit or the ways an idea can be expressed in the context of the study.	Based on the study's research questions, the units needed for the analysis included the identifiers used to represent the protagonist in the text.

3. *Develop categories and a coding scheme.* Create a coding scheme by using a priori theories or research to create deductive categories or generate inductive categories based on the data. A coding scheme is a matrix used to classify the data by category.

A coding scheme was developed based on commonly used demographic identifiers including race, gender, class, and able-bodiedness. The coding scheme is reproduced in Appendix B, and we converted it into a collaborative online form.

4. *Test your coding scheme on a sample of data.* Pilot the coding scheme with a subset of the data, and then check consistency. If the consistency is high, continue the analysis. If the consistency is low, refine the coding scheme's categories and repilot.

We each coded the same 10 apps individually and then met to review consistency levels. We used the Pearson correlation coefficient to check our consistency rate, and it is commonly accepted that ratings of 0.7 or higher are seen as having strong correlation (Mukaka, 2012). All our data had a relationship above 0.7.

5. *Code all the text.* Analyze the remaining data using the coding scheme while continually checking to ensure the consistency of the codes.

Based on the high consistency from our piloting of the coding scheme, we coded all the data. Checks were conducted after every 10 entries to ensure consistency.

6. *Assess your coding consistency.* Check the consistency level of the entire data set once all of it has been entered into the coding scheme.

With all the data coded, we again checked the consistency using the Pearson correlation coefficient for each category, and it remained above 0.7.

7. *Draw conclusions from the coded data.* Make sense of the data by reconstructing it in order to offer findings and implications from the analysis.

We converted our data into pie charts to visualize them and then identified trends and patterns, which would serve as the basis for our findings and implications.

8. *Report your findings and methods.* Present the knowledge learned from the analysis as well as the procedures used to arrive at it. Provide enough information and description so that other researchers can replicate the procedures used in the analysis.

Across our methodology, findings, and implications sections, we were purposeful about sharing our procedure's detail so that our study could be duplicated. We also presented our findings in ways that connect with prior scholarly works and are of value to literacy educators.

Zhang and Wildemuth's (2009) process for conducting a content analysis was useful in this study because it provided a flexible approach for evaluating storybook apps. Being able to classify the protagonist based on our predefined criteria allowed us to be efficient and focused in our analysis. The following section reports our findings.

Findings

This section addresses each research question to fully describe how storybook apps represent their protagonists. In the context of this study, we define protagonist as

the central character of the narrative. Unlike more canonical definitions that require a protagonist to undergo a type of change in response to a challenge of some kind, we chose only to require that the protagonist be the story's central character, because there were apps that did not present a challenge to the protagonist, though most of them did. By omitting the challenge requirement, it allowed us to be more inclusive of the apps analyzed in this study.

Next, each research question is directly addressed. For each question, we open with a description of the question that includes the criteria we analyzed along with our operationalization of its key term(s). We then provide an overview of our analysis for the question followed by apps representative of our ratings. A final point before sharing our analyses is that these apps are analyzed from a Western perspective, which represents only one way of interpreting them, and we discuss this perspective more fully in our limitations section.

What is the protagonist's socioeconomic status? This question analyzes the protagonists' socioeconomic status (SES), and we operationalize it as the character's socioeconomic group in terms of "class." Class is a direct reference to a character's socioeconomic status, and we saw the characters' class being reflected in their clothing, home, and possessions. In addition, we paid specific attention to the language used by the characters to see if there were any references to their SES or class level, such as earning an allowance, needing money for necessities (e.g., food, bills, housing), or affording vacations. Figure 1 shows the results of our assessments.
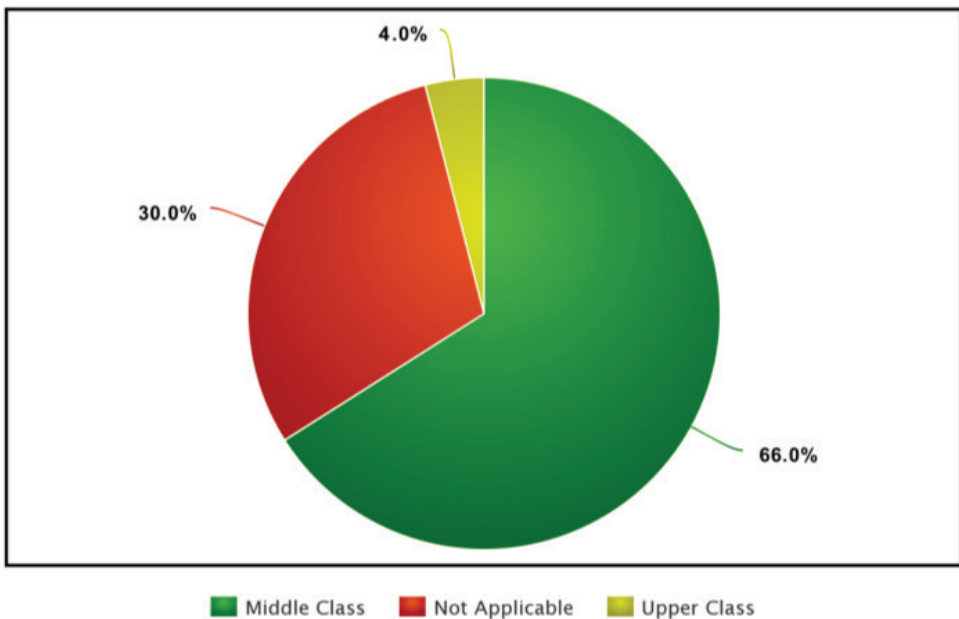

Figure 1

Analysis of the protagonists' SES

When comparing our ratings, we calculated a Pearson correlation coefficient of 0.816 for this group that showed strong agreement in our coding. We further identified the protagonists' homes as being the most influential when assessing their SES, which is explained next.

To begin, the apps rated as *middle class* frequently positioned the protagonist as living in a well-stocked suburban home. In fact, no apps in this group were located in urban or rural settings. Instead, they were mostly located in suburban neighborhoods. For example, in *My Monster Mayhem*, the protagonist lives in a two-story house with a small front yard. *Parcel of Courage* is set in a larger home, but still in a neighborhood setting. Other characteristics of this group were characters eating meals and talking with their parents (e.g., *Mommy and Daddy Say No*). Also, when they did venture out of the house, it was often to purchase household goods (e.g., *Dino-Store*), though a portion of the story still took place in the protagonist's home. Other indicators of middle-class homes include images of modest artwork, an abundance of toys, characters wearing stylish but functional clothes, and food being available. The underlying message was that these characters live comfortably, and the protagonists were having enjoyable childhoods.

The second largest rating was *not applicable*, which meant that SES or class could not be detected. These apps often featured nonhuman characters, including creatures and animals. Some of these apps depicted their protagonist as an animal incapable of human-like interaction, such as in *12 Huia Birds*. This app features birds as its central characters, and it addresses deforestation. At no point in the app do the birds themselves have a social class ranking, so we did not associate one with the app. Other apps, however, did personify characters (e.g., *Moe and the Unexpected Bully, Babel the King, The Monkeys Who Tried to Catch the Moon*). In these cases, we rated them as not applicable because, though the characters were personified, the story was either set in a natural location (e.g., forest) without SES indicators or so whimsical that the construct for SES or class that we understood was not applicable.

The smallest group belongs to the apps coded as *upper class*. Like our ratings of the apps representative of middle class, the homes in these apps are signifiers of SES. For example, *The Selfish Giant Story* was set in a beautiful garden belonging to the giant. The garden was on an estate owned by the giant, which was surrounded by a large stone wall. *Mimi Mouse* was set in a four-story home that includes "a café, a cake shop, everyday rooms" along with a library, and many chandeliers. Both homes depicted in these apps suggest great wealth.

For the middle class and upper class ratings, homes served as the prime indicators based on their size and possessions. The apps where class was not applicable featured animals in ways that we could not contextualize for SES or class; therefore, no rating was assigned.

What is the protagonist's race? With the world growing more diverse, it is important that readers see themselves reflected in the characters. Researchers have identified that young readers connect more deeply with texts when they see themselves positively represented, which helps foster their emerging literacy skills (Landt, 2006; Moss, 2015). In addition, race is not solely a reflection of skin color; rather, there are cultural markers of race, with examples including customs, language, and fashion. We took these markers into account when trying to identify the race of the protagonists, especially because we were not able to ask the characters how they identified, as we would if they were live people who could be interviewed. As such, we relied on our interpretations to identify the protagonists' race. Figure 2 shows the results.
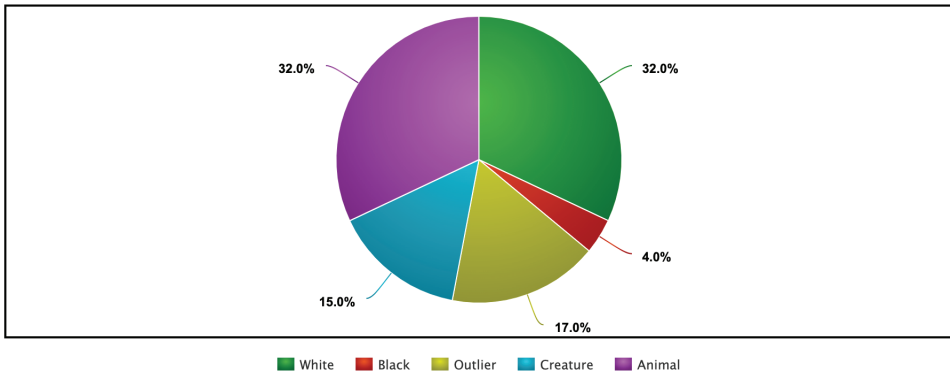
Figure 2

Analysis of the protagonists' race

It should be noted that the protagonists included in this sample were not all human. As such, we created categories in response that expanded this group to include animals, creatures, and outliers as well as humans. Based on our interpretation, a Pearson correlation coefficient of 0.819 was calculated for this group, which evidenced a strong correlation. When we met to discuss our ratings, the main area of disagreement related to classifying characters as animals, creatures, and outliers; the next paragraphs further discuss those distinctions.

The largest group of protagonists were animals. Scholars have long found that storybooks commonly use animals in children's literature (Burke & Copenhaver, 2004; Nikolajeva, 2016), and that trend continued with the apps analyzed in this study. For example, *Millie Was Here: Meet Millie* is centered on a dog with superpowers, though the dog is in fact ordinary. The app does not follow a narrative, with a beginning, middle, and end to the story. Rather, it chronicles Millie as she goes throughout her day. In another example, *Striding Bird* is focused on a bird who no longer wishes to fly because he only wants to live on land, like his four-legged friends. The story exemplifies that each person is unique, and the app uses the bird to express that sentiment to its young readers.

Next, nearly a third of the stories featured White protagonists, and these protagonists ranged from children to adults. The protagonist from *The Artist Who Stole Bits of the World* is Mortimer, who is a White older man and an artist. The story shows Mortimer painting in a variety of settings—the oceanside, a concert hall, and even an airport—in a nondescript town. As the app shows Mortimer in the different settings, it also includes secondary characters in those settings, and all of them are also White. *Oh Tangle* is similar in that it features a White protagonist, but this time she is a teenage girl named Kiki. Throughout the story, Kiki gets into mischief due to her hair, and it also shows Kiki's neighbors and classmates, who are all also White. The apps that were identified as having White protagonists had secondary characters who are frequently White as well, and people of color are seldom represented.

Outliers and creatures are the next two largest categories, and these can be conflated with the animal category. The similarity is that whereas all three are lifeforms that are not human, animals are lifeforms that exist on earth, such as birds, deer, and dogs.

Outliers represent protagonists that were not distinguishable from another category. For example, Pete, who is the protagonist in *Pete's Robot*, appears in a rich yellow shade with blue hair and lives in a world with talking animals who hold jobs, such as postal workers, bakers, and storeowners. This app was an outlier because we did not find any signifiers of race that connected to our understanding of the world. Another outlier app is *I Imagine*, which allows readers to choose their skin color. Because this option was part of the app, we were unable to categorize the race of the protagonist. Creatures, on the hand, represent apps where a nonhuman or nonanimal lifeform of some sort is the protagonist, such as Red in Bed, which featured a color swatch is its main character, and *Oobie's Space Adventure*, in which the protagonist is an alien.

Black protagonists were the smallest category, and these stories were the only ones that included protagonists of color. All of the protagonists were children, and the protagonist from *Roxy and the Ballerina Robot* was the only interracial character shown in the entire data set. In that app, the father, who is White, and the mother, who is Black, teach their daughter about self-discipline by saving money to buy the robot.

What is the protagonist's gender? Similar to race, it is important that all genders are represented in the apps so that young readers can see themselves reflected in the stories they read. Seeing themselves represented fosters engagement and interest in the story. Also, like with race, we were not able to ask the characters how they identify. Therefore, we focused on the language used in the story, with emphasis on the pronouns used to reference the characters (e.g., he/his, she/her, they/them). We also considered dress and appearance to identify the characters' gender. Figure 3 shows our ratings.
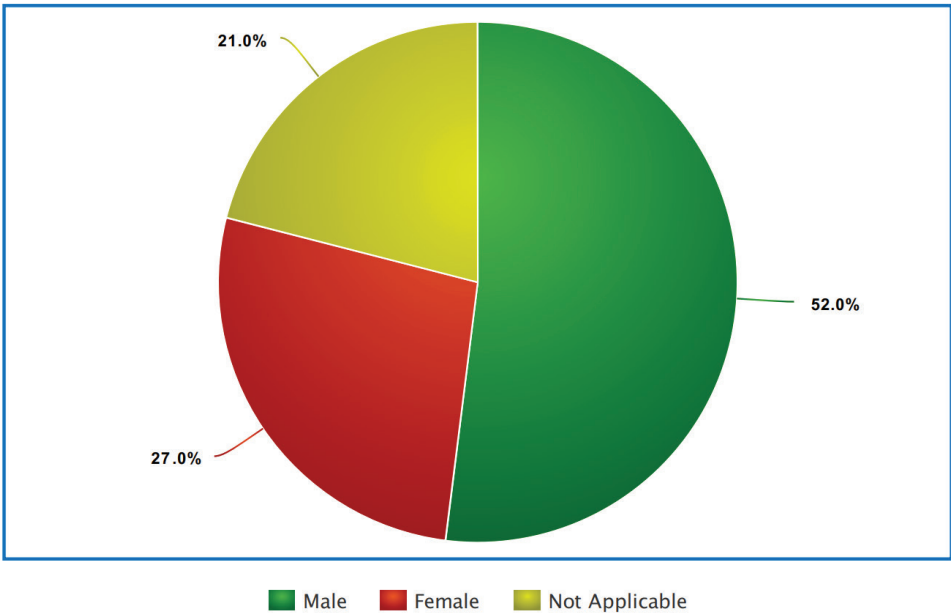

Figure 3
Analysis of the protagonists' gender

The Pearson correlation coefficient for this category was 0.815, which is rated as having a high correlation. When we met to discuss our findings, we grouped the characters whose genders we could not identify as *not applicable* instead of using other classifications, such as animals and aliens. We made this decision because although animals and aliens did appear as protagonists in this study, they were often referred to using gendered terms, such as *he* and *she*. However, when no gendered language was used to reference the characters, we felt classifying those characters in the not applicable category was more appropriate than assigning them a gender. The categories are shared next.

The largest category is that of male protagonists, and it includes protagonists taking the form of children, adults, aliens, and animals. Both *Parcel of Courage* and *Call of the Giant Eagle* feature male protagonists who are children. In the stories, both protagonists are shown wearing pants, having short hair, and using masculine language, and we identified those characteristics as being attributes of the male gender. Apps with animals that were identified as male protagonists include *Mr. Fox and Mr. Rabbit* as well as *Babel, the King*. The former features two characters, the antagonist Mr. Fox and the protagonist Mr. Rabbit, and we identified them as male based on the masculine honorific used in their names. For the latter, the story used masculine pronouns in its opening lines to introduce the protagonist, Babel, to readers: "Babel is a grumpy old cat. He is not very bright at all! His place smells like burnt fur and his life is boring" (p. 1). The gendered pronouns *he* and *his* in these opening sentences position Babel as a male cat. Similarly, the apps with male protagonists who are aliens also use gendered language to speak about them, such as in *Oobie's Space Adventure*. In the story, Oobie travels through space, and it opens with "Oobie is ready to go.… What he'll see, nobody knows!" (pp. 1–2). As the story progresses, there is another use of gendered pronouns: "He'll see asteroids" (p. 6). From these, we identified Oobie as a male, though he appears to be more androgynous.

Female protagonists were the second largest group, though they appeared about half as frequently as male protagonists. None of these apps used any feminine honorific in their title or featured an alien. Rather, animals and children were most commonly portrayed as female protagonists. For example, both *Millie Was Here: Meet Millie* and the *Pink Rhino* identifed the protagonist as female. When the app introduced Mille, it used feminine pronouns: "She seems like an average dog, right? Wrong! An average dog can't make herself invisible" (p. 3). In Pink Rhino, feminine adjectives were used to describe the protagonist telling her story to another character: "She told Bo how the poachers were after her golden horn and how she managed to escape (p. 2). Also, the protagonist's eyelashes were stylized and she is pink, both characteristics that we associated with being feminine. In addition, we identified female protagonists based on their clothes, hair, and voice, such as in *Hey AJ! It's Saturday* and *Mum's Crunky Car*.

The not applicable category includes a range of stories where the gender of the protagonist was unclear, and the reason for these uncertainties varies. For example, the protagonist from *The Tree That Refused to Shed* is the tree, and the app refers to that character as "tree" or with the pronoun "it" during the story. Because no other indicators (e.g., clothing, style, voice) were available to cue its gender, we marked it as not applicable. Other apps included stories about entire groups of animals, but no true protagonist was identified, as in *The Monkeys Who Tried to Catch the Big Moo*n and *The Odd Bird Out*. Furthermore, because the stories focused on the group of animals as a whole and no singular animal, we were not able to identify a specific gender and therefore marked these not applicable. Other apps, including *I Imagine* and *Snow Fox*, allow the readers to choose their character, which includes the protagonist, and we marked them as not applicable

because there was no reliable way to predict the gender a reader would select. Finally, *Red in Bed* used only the characters' names, which were actual colors (e.g., Red, Orange, Yellow), to refer to them. As such, the determinations of gender were unavailable. In all, if gender could not be identified or the protagonist was a group of animals, the app was marked not applicable.

Is the protagonist able-bodied? This question examines if the protagonists are able to fully use their body without support, such as wheelchairs, canes, or hearing aids. We made this assessment by observing how the protagonists were represented. To be clear, this question did not address the protagonists' mental health, because we did not have a reliable way to measure it. Instead, this question is limited solely to the protagonists' ability to move freely and have full users of their senses without aid. Figure 4 shows the results.
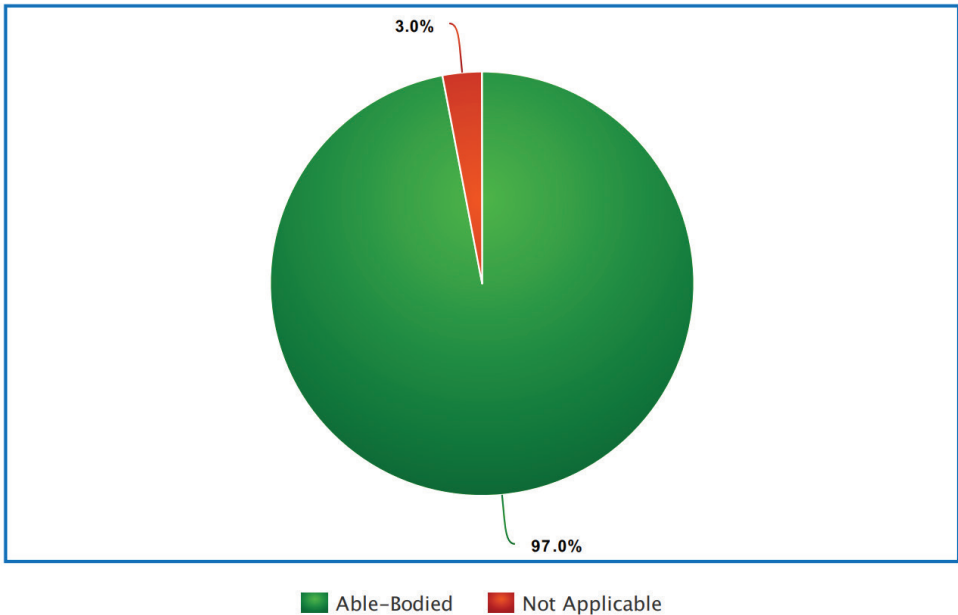

Figure 4

Analysis of the protagonists' able-bodiedness

Though the protagonists took the form of humans along with animals, creatures, and aliens, we rated all of them as being able-bodied, and that is reflected in the Pearson correlation coefficient being 1.0. Across the stories, humans moved and functioned without aids, birds flew, and creatures and aliens moved as would be expected of such lifeforms. Even the colors from *Red in Bed* bounced across the screen. The only protagonist rated as not applicable was the one from T*he Tree That Refused to Shed*. Because the tree did not move, we were unsure of whether it was able-bodied, so we rated it as not applicable.

Implications

This study's purpose was to identify implicit messages and underlying themes in storybook apps. Based on the findings, the preponderance of evidence suggests that White, male, able-bodied, middle-class characters are the central figures across these storybook apps. Looking back to the findings, it was clear that these characteristics combined to form the default protagonist, which continues a longer tradition of White characters being the main characters in children's literature (Hurley, 2005; Rogers & Christian, 2007). This continuation is problematic and significant because the needs of non-White readers go unaddressed (Lazar et al., 2012), especially in a world that is growing more diverse.

Children develop literacy within the context of their cultures, social histories, and immediate sociocultural contexts (Gadsen, 1993; Laminack & Kelly, 2019). Children benefit from books that they can relate to based on their own cultural identity, including their values, beliefs, customs, traditions, and languages. However, this opportunity is not happening for all readers. As shown in the data from the Children's Cooperative Book Center (2021), in both 2018 and 2019, paper-based storybooks were written by non-White authors only 23% of the time and were about non-White cultures just 28% of the time. Though our study did not analyze the race of the authors or developers who published the storybook apps, it did show that trends focused on who the storybook was about carried over, as storybooks apps with Black protagonists constituted just 4% of the sample. For storybook apps to become more equitable and support young readers' development, they need to be Bishop's (1990a) mirrors for children of color to see themselves in the texts they are reading as well as windows and sliding doors for White children to learn about cultures besides their own. In this way, storybook apps can become opportunities for younger readers to see and learn about our pluralistic, multicultural world, as opposed to a one-dimensional world that is solely a reflection of White culture (Laminack & Kelly, 2019).

In the United States, White students comprise less than 50% of the public school population (National Center for Education Statistics, 2017), and the nation as a whole is expected to grow more diverse (Keating & Karklis, 2016). Because the importance of early reading experiences is paramount, there is a disconnect between the protagonists featured in the storybooks and who is reading them. These reading experiences build the foundational knowledge that children use to make sense of the world. For example, in Sandefur and Moore's (2004) study, the negative depictions of teachers were found to be influential in terms of the children's understanding of teachers, and that is before they enter school. In addition, it may harm children's motivation to read. Ebe's (2010) research indicated that there is a relationship between reading proficiency and the cultural relevance of texts. She found that children's reading comprehension improves when a text is culturally relevant to them because they are able to connect with the text by using their background knowledge and experiences to construct meaning from it. Culturally relevant texts foster greater engagement, and engagement is a strong predictor of reading achievement (Ebe, 2010; Guthrie et al., 2001).

Furthermore, although females comprise 50% of the population in the United States (U.S. Census Bureau, 2020), they were represented in just 27% of the apps. In fact, females appeared in only 6% more of the apps than did the not applicable characters. This finding exemplifies females continuing to be displaced by male characters (McDonald, 1989) and suggests that patriarchy is being reinforced through the depictions of male protagonists; young girls are not seeing themselves represented in these roles. Extending Bishop's (1990a) metaphor to gender, storybooks apps can be the mirrors, windows, and

sliding doors to show young readers multiple opportunities and pathways for females to take as they develop into teenagers and adults.

Similarly, over 70% of these apps were set in middle- or upper-class contexts. However, 29% of the population in the United States is lower class (Kochhar, 2018), and they are not even referenced in these apps. When children are not given the opportunity to grapple with depictions of poverty or individuals struggling to make a living, they may not recognize or be aware of the hardships that fall outside of people living in a middle-class society. And this may impact children's ability to be emphatic, compassionate, or advocates to and for people who live outside of the middle or upper class. The storybook apps are largely mirrors reflecting middle-class values and lifestyles—with limited opportunities for young readers to peer through windows to see different social classes—and this is true of being able-bodied as well.

One in four Americans identifying as having some sort of disability (Okoro et al., 2018), but not one protagonist in this sample was depicted as having a disability of any sort. This omission is troublesome because children should see that there are different disabilities in the world and that not everyone is able-bodied. Again, by showing only able-bodied protagonists, the storybooks reflect a view of able-bodiedness that is not representative of the population in the United States, and the storybooks are not giving young readers opportunities to see other ways of moving and existing in the world.

Recommendations

This study's findings provide evidence that the individuals who are authoring and developing these storybook apps are embedding their implicit biases within them. But there are strategies that teacher educators can use to prepare preservice teachers for selecting storybook apps along with methods for in-service teachers. This section first provides ideas for teacher educators, preservice teachers, and in-service teachers to engage this work before making suggestions focused on the authors and developers of storybook apps. It concludes with recommendations for future researchers.

Ideas for Teacher Educators, Preservice Teachers, and In-Service Teachers

Teacher educators who prepare preservice teachers need to be cognizant of the implicitness found in storybook apps. For example, they can have preservice teachers read storybook apps along with paper-based storybooks. They can then use Laminack and Kelly's (2019) questions to critically analyze the content of both the storybook apps and paper-based books. Next, teacher educators can facilitate a conversation in which preservice teachers share the information they learned from conducting that analysis in class. Moreover, they can have preservice teachers visit the children's section of different libraries and book collections to analyze those texts using Laminack and Kelly's questions and then report back to the class. This activity can then build a foundation to use Bishop's (1990a) metaphors to build a text set.

After having preservice teachers explore texts, teacher educators can introduce a class project in which students collectively and collaboratively develop a list of recommended storybook apps. To vet the apps, the preservice teachers can use Bishop's (1990a) mirrors, windows, and sliding doors to identify the apps for inclusion in the text set and how those texts can be used. It is important to remember that though an app might be a mirror for one young reader, it could be a window for another reader, and that presents teacher educators with the opportunity to teach preservice teachers about matching students to texts based on qualitative factors outside of quantitative reading scores (Hiebert, 2013).

Co-constructing this type of text set with their peers provides preservice teachers with an authentic experience selecting storybook apps analyzing the perspective shared by those apps and matching those texts to students. They will then be able to draw on that experience and the text set as they begin their careers. In addition, in-service teachers have the opportunity to reevaluate the texts they recommend to students and their parents/guardians in light of this study.

With the rise in popularity of storybook apps, this study demonstrated that the implicitness of White, middle-class culture continues to be a prevalent theme. Based on this study, along with the analysis from the Children's Cooperative Book Center (2021), teachers can analyze the texts they are using with their students to determine whether they are functioning as mirrors that reflect their students' culture(s) or windows for students to view other cultures besides their own. In that regard, teachers should determine for whom the text will serve as a mirror or window and work to ensure there is equitable representation for their students. Then, for in-service teachers who host preservice teachers, they can demonstrate their process for making those determinations with the texts they offer their students. It is also important that in-service teachers conduct these checks periodically because individuals' understandings and perspectives of texts change.

In her theory, Rosenblatt (1988) explained that as people acquire more life experience and background knowledge, their understanding of texts changes, as reflected by Margalit's (2014) experience with *The Giving Tree*. Bishop's (1990a) mirrors, windows, and sliding glass doors along with Laminack and Kelly's (2019) critical questions provide teachers with the tools to recenter and refocus on the content of a text. Though individuals' interpretations of texts will change over time, developing the habits of mind to view and question texts in those ways gives teachers an anchor to assess whether the texts they include in their classroom and recommend to students contain culturally relevant attributes needed for pedagogy that is responsive to students' needs. It is recommended that in-service teachers conduct an audit of their texts for those purposes, with the days leading up to the beginning of the school year being an ideal time for that audit to happen.

The ideas shared in this section are positioned as starting points for teacher educators, preservice teachers, and in-service teachers to engage this work. However, they should not view these options as the only ways to evaluate the cultural relevance of the texts they use with their students. Rather, they should draw from these ideas in order to advance them so that they are usable and implementable in their instructional contexts.

Suggestions for Authors and Developers of Storybook Apps

Implicit biases are embedded in media of all sorts (Noble, 2018; O'Neil, 2016), and storybook apps are no exception. With these types of early reading experiences continuing to be produced, the authors of these storybooks have the opportunity to make their characters more reflective of our diverse society. Based on the findings of this study, the characters who are represented are not reflective of society's demographic makeup. The authors can be more intentional about who is in their stories to increase the amount of inclusivity provided by their storybook apps. They can include characters who have diverse friends, come from different backgrounds, and have disabilities of some kind. They can show their characters thriving in diverse communities and interacting with people from a variety of backgrounds, inclusive of gender, race, and people with disabilities. These recommendations are ways that authors can add windows into their storybook apps that show diverse cultures, which will increase their inclusivity and authentic representations.

App developers can also be more critical of the storybooks they develop. They

can point out many of the elements discussed in this study to authors. They can highlight the lack of diversity and which elements are and are not being represented in the storybook they were hired to develop. That way, they can act as a sounding board and source of feedback to authors.

Recommendations for Future Researchers

Future researchers have an opportunity to continue this line of inquiry. Applying content analysis methodology to storybook apps presents a range of possibilities. Researchers can replicate this study but shift its focus to apps for middle schoolers or ones for conducting science experiments. They can analyze storybook apps for different elements, such as types of conflict (e.g., man vs. self, man vs. man), settings, and even antagonists. This study demonstrated that an emphasis on whiteness that started in other literary genres continues to be found in storybook apps. Conducting more research in this area will continue the call to increase diversity not just in storybook apps, but in the larger fields of literacy education and educational technology (Damarin, 1998; Kazimzade et al., 2019). As children are developing new literacies with the influx of digital technologies, the two fields are intertwined, with one informing the other. In this way, in-service teachers, preservice teachers, teacher educators, authors, developers, and researchers can all play a part in responding to the lack of representation in children's storybook apps.

Conclusions

It is highly likely that storybooks will continue appearing in the form of apps for many years to come. This study revealed that similar to their paper-based predecessors, storybook apps contain implicit messages and underlying themes. These apps most often tell the story of White, able-bodied, middle-class protagonists who are male. Protagonists who do not fit those criteria appear in significantly fewer storybooks than protagonists who do have those characteristics. Because the children who are transacting with these apps are becoming more diverse, as indicated by current population data, they are not seeing themselves in the storybooks they are reading. The result is that children who are beginning to conceptualize their world do not often include themselves in it, because they are more frequently seeing White, male, middle-class, and able-bodied protagonists in the storybooks they can access. Teacher educators, preservice and in-service teachers, authors and developers of storybooks, and researchers have the ability to address this issue in their work. By taking the actions recommended earlier, they can improve the amount of diversity and representation in storybook apps to create mirrors, windows, and sliding doors for all children.

Limitations

We recognize that limitations impacted this study. First, this research was largely limited to our interpretations of the apps. Our positionality as researchers with varying backgrounds may have impacted our interpretations. Other researchers with different backgrounds, experiences, and knowledge bases may transact with the storybook apps and arrive at alternative understandings and ratings. Second, our use of Google is a limitation because of its algorithm (Noble, 2018). For example, blogs that did not contain the "right" search engine optimization needed to appear in Google's results may have not been reported. Researchers replicating this study at another time or using a different search engine will likely identify a different sample of apps. Third, this study cannot claim that all the storybook apps that existed during data collection were reviewed. With strict inclusion criteria, we streamlined our data collection procedures needed for saturation (Morse, 1995), but doing so may have excluded apps from this analysis. Fourth, because

this study analyzed apps, it did not include a way for developers to explain their decision-making process for representing characters; they may have made strategic decisions for why they used particular shades in their characters' skin tones. We realize these limitations did have an impact on our study. However, by honoring the need for rich description in our methodology and our findings along with a strict coherence to our theoretical framework, we see our study as being valid and important to the field of literacy education and children's literature.

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Appendix A. List of Apps Reviewed in this Study

1. The Artist Who Stole Bits of the World
2. Millie Was Here: Meet Millie
3. 3The Icky Mr. Fox
4. Snow Fox
5. Roxy and the Ballerina Robot
6. Oh, What a Tangle!
7. Oobie's Space Adventure
8. Pete's Robot
9. My Monster Mayhem
10. Striding Bird
11. Dino-Store
12. Red in Bed
13. Mr. Fox & Mr. Rabbit
14. Babel, the King
15. Picked on Poindexter
16. I Imagine
17. The Selfish Giant
18. Mommy and Daddy Say No
19. Locke Saves the Town
20. The Monkeys Who Tried to Catch the Moon
21. Mum's Cronky Car Kids Bedtime Story
22. The Tree That Refused to Shed
23. Ooks
24. Parcel of Courage
25. Itty Bitty Bug's Big Party
26. A Fantastic Journey
27. The Miniature Polar Bear
28. Gabe and the Pesky Bug
29. Mimi Mouse
30. Monster and Cat
31. Hey AJ! It's Saturday
32. Moe and the Unexpected Bully
33. The Odd Bird Out
34. 12 Hula Birds
35. Call of the Giant Eagle—Curious Critters: Giant Eagle
36. The Explorers Club
37. Curious Critters Club: The Mystery of Caddy
38. Pink Rhino

Appendix B. Replication of the Coding Matrix Questions

1.	What is the race of the protagonist?		

A.	Asian	F.	Animal
B.	Black	G.	Creature
C.	Hispanic	H.	Not applicable
D.	Middle Eastern	I.	Other: _____
E.	White		

2.	What is the gender of the protagonist?

A. Female

B. Male

C. Transgender

D. Not applicable

E. Other: _____

3.	What is the class of the protagonist?

A. Lower class

B. Middle class

C. Upper class

D. Not applicable

E. Other: _____

4.	Is the protagonist able-bodied? If not, what disability may the protagonist have?

A.	Able-bodied	E.	Crutches
B.	Blind	F.	Not applicable
C.	Hard of hearing	G.	Other: _____
D.	Wheelchair		

5.	What other information would you like to share about this app?