

A Review on Designing Electronic books for Children with Autism

Wang Beili^{1,2}, Saiful Hasley Ramli¹, Dai Na^{1,3}

¹Department of Industrial Design, Faculty of Design and Architecture, Universiti Putra Malaysia, Serdang, 43400, MALAYSIA, ²Guangdong University of Science and Technology, No. 99, Xihu Road, Nancheng District, Dongguan City, Guangdong Province 523083, China, ³School of Art, Sichuan Tourism University, No. 459, Hong ling Road, Long Quan Yi District, Chengdu 610100, CHINA

Corresponding Author Email: shr@upm.edu.my

To Link this Article: <http://dx.doi.org/10.6007/IJARBSS/v13-i8/18222> DOI:10.6007/IJARBSS/v13-i8/18222

Published Date: 19 August 2023

Abstract

Individuals with autism spectrum disorders often benefit from technology-based interventions. Technologies being marketed to the autism community and relevant published research are proliferating. As a neural developmental disorder, autism spectrum disorder brings great challenges to families of children with autism and society as a whole. Preschool intervention, assisted by parents, is capable of enabling autistic children to acquire life skills quickly and efficiently. A picture book, a commonly known tool of art therapy, was proven beneficial for preschool education. Meanwhile, modern technology has provided more interactive and educational opportunities for traditional picture books. Therefore, the behavioral characteristics of autistic children are analyzed, and the related design theories and principles of e-books are obtained through the method of literature review so as to provide theoretical support for the research on product design for edutainment for autistic children.

Keywords: Electronic Books, Children with Autism, Emotional Development

Introduction

Autism—also referred to as autism spectrum disorder—constitutes a diverse group of conditions related to development of the brain. About 1 in 100 children has autism. Characteristics may be detected in early childhood, but autism is often not diagnosed until much later. The abilities and needs of autistic people vary and can evolve over time. While some people with autism can live independently, others have severe disabilities and require life-long care and support. Evidence-based psychosocial interventions can improve communication and social skills, with a positive impact on the well-being and quality of life of both autistic people and their caregivers. Care for people with autism needs to be

accompanied by actions at community and societal levels for greater accessibility, inclusivity and support (World Health Organization, 2019).

Autism spectrum disorder (ASD) presents unique challenges for families in education, with communication barriers, social skills deficits, sensory sensitivities, specialized educational needs, challenging behaviors, academic challenges, limited access to support services, parental stress and burnout, stigma and social isolation, and transition planning. Each individual with autism has unique strengths and abilities, making it challenging for families to navigate these difficulties and help their children reach their full potential in education and beyond. Communication barriers, social skills deficits, sensory sensitivities, specialized educational needs, challenging behaviors, academic challenges, limited access to support services, parental stress and burnout, stigma and social isolation, and transition planning are just a few of the challenges faced by autistic families. Therefore, through the method of literature review, the behavioral characteristics of autistic children are analyzed, and the relevant design theories and principles of e-books are obtained, which provide theoretical support for the research of product design for autistic children through edutainment and provide more support for autistic families.

Literature Review

The behavioral characteristics of children with ASD

Autism is a complex disorder characterized by deficits in communication and social functioning, as well as restrictive and repetitive behaviors (Zhao et al., 2019). One of the key difficulties faced by autistic children is in the domain of communication ("The Social Brain And Social Communication In Autism", 2023). Communication difficulties in autism can manifest in various ways, including delays in language development, impaired functional communication, and altered perception of speech (Smith & Bennetto, 2007). Research has shown that there may be distinct subgroups within autism based on differences in neurocognitive profiles (Tager-Flusberg & Joseph, 2003). These subgroups can be defined based on language profiles and cognitive profiles (Tager-Flusberg & Joseph, 2003). For example, some autistic children may exhibit delays and deficits in joint attention and symbolic play, which are important developmental skills (McConachie, 2006). Interventions targeting joint attention and symbolic play have shown promising results in improving these skills in young children with autism (McConachie, 2006).

The social interaction of autistic children is a core area of difficulty for individuals with autism spectrum disorder (ASD) (Dawson et al., 2010). Autistic children often struggle with social communication, social skills, and understanding social cues (Dawson et al., 2010). However, early intervention programs, such as the Early Start Denver Model (ESDM), have shown promise in improving social interaction outcomes for autistic children (Dawson et al., 2010). The ESDM is a comprehensive developmental behavioral intervention that is based on developmental and applied behavioral analytic principles (Dawson et al., 2010). It involves trained therapists and parents working together to deliver the intervention for a period of two years (Dawson et al., 2010). A randomized controlled trial conducted by Dawson et al. (2010) evaluated the efficacy of the ESDM in improving outcomes for toddlers diagnosed with ASD (Dawson et al., 2010). The study randomly assigned 48 children diagnosed with ASD between 18 and 30 months of age to either the ESDM intervention group or a group that received referral to community providers for commonly available intervention (Dawson et al., 2010). The results of the study showed that children who received the ESDM intervention

demonstrated significant improvements in IQ, adaptive behavior, and autism diagnosis compared to those who received community intervention (Dawson et al., 2010).

Furthermore, the study found that children who received the ESDM intervention were more likely to experience a change in diagnosis from autism to pervasive developmental disorder, not otherwise specified (Dawson et al., 2010). This suggests that the ESDM intervention may have a positive impact on reducing the severity of the ASD diagnosis (Dawson et al., 2010). The findings of this study highlight the importance of early detection and intervention in autism (Dawson et al., 2010). Early intervention programs like the ESDM can play a crucial role in improving social interaction outcomes for autistic children by targeting social communication skills, social engagement, and social reciprocity (Dawson et al., 2010). By providing structured and individualized support, these interventions aim to enhance social interaction abilities and promote better social integration for autistic children. Baron-Cohen's study aimed to investigate the effectiveness of an interactive multimedia program called Mind Reading in teaching adults with Asperger syndrome (AS) and high-functioning autism (HFA) to recognize complex emotions in faces and voices. The participants, diagnosed with AS/HFA, used the software at home for 10-15 weeks. The study assessed their recognition of faces and voices at different levels of generalization (Baron-Cohen, 2006).

Restricted and repetitive behaviors (RRBs) are a core feature of autism spectrum disorder (ASD) (Bishop et al., 2012). These behaviors can be subdivided into different categories, such as repetitive sensory motor (RSM) behaviors and insistence on sameness (IS) behaviors (Bishop et al., 2012). Research has supported the construct validity of these subcategories, particularly IS behaviors, which have shown no relationship with IQ (Bishop et al., 2012). Autistic children often display restricted and stereotyped behaviors in their interests and activities (Bandim et al., 2003). These behaviors can serve as coping mechanisms and may hold value for autistic individuals (Kapp et al., 2019). Autistic adults have advocated for the acceptance and understanding of these behaviors, known as "stimming" (Kapp et al., 2019). Research has explored the perceptions and experiences of stimming from the perspective of autistic adults, highlighting the need for a broader understanding of these behaviors (Kapp et al., 2019).

Attachment behaviors in autistic children have also been studied. Autistic children have shown evidence of attachment to their caregivers, directing more social behaviors and physical contact to their caregivers compared to strangers during reunion episodes (Sigman & Ungerer, 1984). The presence of attachment behaviors has been associated with more advanced symbolic play skills in autistic children (Sigman & Ungerer, 1984). However, social behaviors of autistic children have been less investigated directly, and further research is needed in this area (Sigman & Ungerer, 1984).

In summary, restricted and repetitive behaviors are a core feature of ASD. These behaviors can be categorized into different subcategories, such as RSM and IS behaviors. Early intervention has shown positive outcomes in terms of cognitive and communication abilities, as well as a reduction in ASD symptom severity. Autistic individuals often display restricted and stereotyped behaviors, which may serve as coping mechanisms. Attachment behaviors have been observed in autistic children, highlighting their capacity for forming social connections. Further research is needed to better understand and support individuals with ASD in managing and expressing their restricted and repetitive behaviors.

The influence of e-book design on the emotional development of children with autism

Children with autism often exhibit deficits in emotional understanding and social behavior (Downs & Smith, 2004). They may have difficulty recognizing emotional expressions in photographs or displaying cooperative social behavior (Downs & Smith, 2004). Additionally, children with autism may struggle with identifying and differentiating their own emotions (Rieffe et al., 2006). These social-emotional deficits can impact their interactions and relationships with others (Scambler et al., 2006). The design of e-books can potentially play a role in supporting the emotional development of children with autism. For example, the use of interactive features and visual cues in e-books may help children with autism better understand and recognize emotions (Barakova & Lourens, 2010). By incorporating emotional movements and expressions into e-books, children with autism may have the opportunity to practice and improve their emotional discrimination skills (Alshirawi & Hajji, 2023). However, it is important to note that the effectiveness of e-book design in promoting emotional development in children with autism has not been extensively studied. Most of the existing research focuses on traditional interventions and behavioral treatment programs (Downs & Smith, 2004). Therefore, more research is needed to explore the specific impact of e-book design on the emotional development of children with autism.

The perception of emotions in children with autism is an important area of research. One study by Golan and Baron-Cohen (2006) aimed to evaluate the effectiveness of an interactive multimedia program called Mind Reading in teaching adults with Asperger syndrome (AS) and high-functioning autism (HFA) to recognize complex emotions in faces and voices. The study involved two experiments. In Experiment 1, a group of adults diagnosed with AS/HFA ($n = 19$) used the Mind Reading software at home for 10-15 weeks. They were then tested on their recognition of faces and voices at three different levels of generalization. The results showed that using Mind Reading for a relatively short period of time allowed the participants to learn to recognize a variety of complex emotions and mental states (Golan & Baron-Cohen, 2006). However, the study also noted that additional methods may be required to enhance generalization (Golan & Baron-Cohen, 2006). In Experiment 2, the intervention group (adults with AS/HFA using Mind Reading) was compared to a control group of adults with AS/HFA attending social skills training and a general population control group ($n = 13$ for all three groups). The results showed that the intervention group improved significantly more than the control group on close, but not distant, generalization tasks. Verbal IQ was found to have significant effects in Experiment 2 (Golan & Baron-Cohen, 2006). Additionally, a matched control group of adults with AS/HFA ($n = 22$) was assessed without any intervention. This control group allowed for a comparison of the intervention group's progress to the natural progression of emotion recognition skills in adults with AS/HFA (Golan & Baron-Cohen, 2006). Overall, the study by Golan and Baron-Cohen (2006) suggests that interactive multimedia programs like Mind Reading can be effective in teaching individuals with AS/HFA to recognize complex emotions. However, further research is needed to explore additional methods to enhance generalization and understand the impact of each factor.

Children with autism often struggle with emotion perception, which is essential for social communication and interaction. Common challenges include difficulty recognizing facial expressions, limited eye contact, less focus on social cues, sensory sensitivities, contextual understanding, theory of mind difficulties, generalizing emotions, and literal interpretation of language. These difficulties can lead to misunderstandings in social interactions and hinder their ability to understand others' emotions.

However, children with autism can also have specific strengths, such as attention to detail or pattern recognition, which can be used to enhance emotion perception and social communication skills. Therapies like Applied Behavior Analysis (ABA) and social skills training can help improve emotion perception and social understanding in children with autism. Early intervention and tailored support are crucial in helping these children develop their emotional intelligence and navigate social interactions more effectively.

Autism is a spectrum disorder that can manifest in various ways and severity, making emotional expression in children with autism significantly different from that in neurotypical children. Common patterns and challenges include difficulty reading facial expressions, limited eye contact, atypical emotional responses, delayed emotional development, sensory overload, communication difficulties, repetitive behaviors, and social challenges. Children with autism may struggle to understand others' emotions, leading to misunderstandings. They may also have difficulty making eye contact, which is crucial for conveying and understanding emotions. Delayed emotional development can result in less varied or age-appropriate responses. Sensory overload can lead to emotional meltdowns or shutdowns, making it challenging for children with autism to regulate their emotions effectively. Communication difficulties, such as limited speech or difficulty finding words to describe emotions, can also be common in autism. Engaging in repetitive behaviors or special interests can help children with autism self-regulate their emotions and cope with overwhelming situations.

The expression of emotions in children with autism is a topic of interest in research. One study by Hobson (1986) investigated the ability of autistic children to appraise expressions of emotion. The study compared groups of autistic children, typically developing children, and intellectually disabled children without autism. The participants were tested on their ability to choose drawn and photographed facial expressions of emotion that corresponded with a person's gestures, vocalizations, and contextual cues indicative of four emotional states. The results showed that both the autistic and control groups were proficient in selecting drawings of non-personal objects to match the videotaped cues. However, the autistic children exhibited significant impairments in selecting the appropriate facial expressions for the videotaped expressions and contexts compared to the control group (Hobson, 1986). Within the autistic group, the performance varied among the children. The study highlighted the heterogeneity of emotion appraisal abilities in autistic children. Some children with autism showed more impaired performance in this task compared to others (Hobson, 1986). This study suggests that children with autism may have difficulties accurately perceiving and expressing emotions through facial expressions. The findings indicate that autistic children may struggle with understanding and interpreting emotional cues from others, which can impact their social interactions and communication skills. It is important to note that this study was conducted in 1986, and more recent research has further explored the emotion expression abilities of children with autism. However, Hobson's (1986) study provides valuable insights into the challenges faced by autistic children in appraising expressions of emotion.

Children with autism often experience challenges in providing feedback due to difficulties in social communication and understanding emotions. Research has explored various aspects of feedback in children with autism, including social attention impairments, joint attention, symbolic play, and motor learning. A study by Dawson et al (2004) investigated social attention impairments in autism, including social orienting, joint attention, and attention to

distress. The study found that children with autism performed significantly worse than typically developing children in these domains. The impairments in joint attention and social orientation were found to be particularly distinguishing features of autism. The study also highlighted the importance of joint attention in predicting language ability in children with autism. Another study by Charman et al (1997) examined empathy, joint attention, and imitation in infants with autism. The study found that infants with autism showed specific impairments in social gaze, empathy, joint attention, and imitation compared to typically developing and developmentally delayed children. The findings suggest that deficits in these areas may be early markers of autism. In terms of interventions, McConachie (2006) conducted a randomized controlled intervention study focusing on joint attention and symbolic play in young children with autism. The study found that targeted interventions in these areas led to improvements in joint attention, symbolic play, and mother-child interactions. The results suggest the potential effectiveness of early interventions in improving social communication skills in children with autism. Furthermore, Reed (2023) investigated the impact of verbal feedback on children with autism during a categorization task. The study found that children with autism learned the initial categorization rule as fast as typically developing children, and the type of feedback (verbal or nonverbal) had little impact on acquisition. This suggests that children with autism may not be differentially sensitive to verbal feedback compared to typically developing children. Overall, these studies highlight the challenges children with autism face in providing feedback, particularly in the areas of social attention, joint attention, symbolic play, and motor learning. Early interventions targeting these areas may help improve social communication skills in children with autism.

Electronic book design for children with autism

One key element of an e-book is the website or online platform through which it is accessed. The quality and features of the website play a crucial role in building consumer trust and enhancing the user experience (Kaabachi et al., 2019). In the context of e-banking, the website is considered an important variable for building consumer trust (Kaabachi et al., 2019). Similarly, in the field of e-commerce, the website features are analyzed to strengthen customer relationships and improve the user experience (Fedushko & Ustyianovych, 2022). The website for an e-book should have certain characteristics to ensure a positive user experience. These characteristics include a small, intuitive, and meaningful set of features used for scoring (Attali & Burstein, 2004). The scoring model and standards used for evaluating the e-book should be transparent and flexible, allowing for expert judgment (Attali & Burstein, 2004). It is important for the website to provide a user-friendly interface and navigation system to facilitate easy access to the e-book content (Kaabachi et al., 2019). Furthermore, the website should also consider the preferences and expectations of different types of users. For example, customers of multichannel retailers and pure e-tailers may have different evaluations of website features and how they impact trust and loyalty (Kaabachi et al., 2019). Understanding these differences can help tailor the website to meet the specific needs of different user groups (Kaabachi et al., 2019). In addition to the website, other key elements of an e-book include the content itself and the format in which it is presented. The content should be well-written, informative, and engaging to attract and retain readers (Attali & Burstein, 2004). The format should be compatible with various devices and screen sizes to ensure accessibility and ease of reading (Kaabachi et al., 2019). Overall, the website is a crucial

element of an e-book, as it serves as the platform for accessing and interacting with the content.

The website is a crucial element of an e-book, as it plays a vital role in building consumer trust and enhancing the user experience. In e-banking and e-commerce, the website's features are analyzed to strengthen customer relationships and improve the user experience. To ensure a positive user experience, the website should have small, intuitive, and meaningful features for scoring, be transparent and flexible for expert judgment, provide a user-friendly interface and navigation system, and consider the preferences and expectations of different user groups. Understanding these differences can help tailor the website to meet the specific needs of different user groups.

In addition to the website, the content and format of the e-book should be well-written, informative, and engaging to attract and retain readers. The format should be compatible with various devices and screen sizes to ensure accessibility and ease of reading. Overall, the website is a vital element of an e-book, serving as the platform for accessing and interacting with the content.

Electronic books (e-books) implemented on tablets or other digital devices present an opportunity to help children learn from storybooks and help adults maintain an interactive style while reading to children. With respect to children's learning, e-books typically include two kinds of features designed to enhance learning and engagement: multimedia features such as visual animation and sound facilitate vocabulary learning and story comprehension (Takacs, 2015). Highlighted text that is congruent with narration to facilitate text tracking may promote attention to print and facilitate the acquisition of print concepts (Takacs, 2015). Interactive features may be built in to explicitly teach skills such as word meanings through the use of pop-up dictionaries or skill-based games. These kinds of features could also be used to aid the adult reader by suggesting literal and inferential prompts for engaging the child's attention to new vocabulary, story grammar elements, or print concepts (Takacs, 2015). Notwithstanding the potential of e-books to provide support for children's language and literacy learning during shared book reading, there are substantive concerns about the likelihood that e-books might harm the shared reading process. Although children are highly engaged by the multimedia and interactive features found in e-books, parents prefer to share print books with their children. Observations of parent-child interactions with e-books sometimes yield positive interactions during which beneficial dialogic reading exchanges occur; sometimes, however, the exchanges are marked by conflict over control of the device and a significant increase in talk devoted to managing the child's behavior and use of the technology. Furthermore, some e-books with interactive elements that are "inconsiderate" or incongruent with the story interfere with the child's story comprehension; in addition, during story retelling, children recall fewer details when exposed to e-books with interactive features compared to more basic e-books.

E-books, short for electronic books, offer a wide range of functions and benefits to readers and authors. They provide a digital format for reading books, magazines, articles, and other written content, making them convenient and portable. E-books also offer accessibility, as they can be downloaded instantly from online platforms, making them accessible to readers worldwide. They are often more affordable than print books, offering many free or discounted options. E-books also offer search and navigation features, customization options, multimedia integration, ease of distribution, self-publishing, instant delivery, annotation and highlighting, and being environmentally friendly. E-books have revolutionized the publishing

industry, providing readers and authors with exciting opportunities in the digital age. Overall, e-books combine the benefits of digital technology with the joy of reading, offering readers a flexible and accessible way to enjoy literature and informational content.

As digital products become embedded in all aspects of people's lives—work, study, and amusement—emerging computer technologies are producing visual experiences that cannot be provided by traditional intervention tools. These innovative technologies have been shown to reduce symptoms associated with autism. Most people with ASD show a natural affinity for technology and have positive attitudes toward computer-based training. Computer-based tools typically use 2D graphics for animation and game designs, which ask children to watch an animated video (Ohtake et al., 2015), engage in a role-playing game, or imitate facial expressions (Ohtake et al., 2015).

The classifications of electronic books can be based on learner comprehension, control, and style; digital narrative forms; borrowing and usage; preferences and usage; and design methodologies and principles for children's technologies (Dillon & Gabbard, 1998). study the effects of increased learner control in hypermedia environments and individual differences in learner responses to hypermedia. Ozbay and Ugurelli classify electronically augmented literary texts, digitally originated literary texts, illustrated electronic books, audiobooks, and multimedia books. Karakaya et al (2018) emphasize the importance of borrowing and usage, while Clark et al (2019) suggest a preference for physical media over electronic books, except for reference works.

Electronic book design is a relatively new and evolving field, with various classifications based on various criteria. Some common e-book formats include PDF, EPUB, MOBI, and AZW. PDF preserves the layout and appearance of the original document, while EPUB allows content to adapt to different devices and screen sizes. MOBI is a format for e-books that can be read on Kindle devices and applications, while AZW is a proprietary format for e-books.

E-books can be classified by their format, genre, purpose, and intended audience. Fiction, non-fiction, poetry, drama, and purpose are common e-book genres. Non-fiction provides information or facts about real or existing topics, while poetry expresses emotions or ideas through rhythmic and aesthetic language. Drama presents dialogue and action through characters and scenes.

The purpose of e-books is the intended use or audience. Educational e-books aim to teach or instruct the reader about a specific subject or skill, while entertainment e-books aim to amuse or interest the reader for pleasure. Professional e-books assist or support the reader in their work or career, while personal e-books express or reflect the author's personal views or experiences. Overall, e-books are a growing and evolving field that offers various categories of content and formats to cater to different audiences.

The legibility of electronic books, also known as e-books, is influenced by various factors related to their design and the devices used to read them. Key aspects that affect legibility include typography, screen quality, brightness and contrast, text alignment, line and paragraph spacing, background color, responsive design, multimedia content, navigation and interface, device and font rendering, and reader preferences.

The visual design of an e-book plays a crucial role in engaging readers. Consider using appropriate typography, color schemes, and layout to enhance readability and create an aesthetically pleasing experience. Visual elements such as images, illustrations, and infographics can also be incorporated to enhance the content (Li, 2021). E-books provide the opportunity to incorporate multimedia elements such as videos, audio clips, and interactive

features. These elements can enhance the learning experience and make the content more engaging and interactive (Ahmed, 2022).

Typography is crucial for e-book designers to choose fonts that are easy to read on screens and offer different font size options to accommodate readers with varying visual preferences. Screen quality is also crucial, with high-resolution screens with good contrast and color accuracy enhancing the reading experience and reducing eye strain. Adjusting brightness and contrast settings on the reading device can also impact legibility, and proper text alignment, line and paragraph spacing, background color, responsive design, multimedia content, navigation and interface, device and font rendering, and reader preferences can all impact the legibility of e-books. By paying attention to these factors, e-book designers can optimize legibility and provide a more enjoyable reading experience for their audience.

Logical and systematic e-books are digital books that are organized in a clear, coherent, and structured manner, making it easy for readers to follow the content and understand the information presented. These e-books typically adhere to a well-defined structure and logical flow, ensuring that the material is presented in a progressive and organized manner. Key characteristics of logical and systematic e-books include a clear Table of Contents, sequential flow, headings and subheadings, consistent formatting, logical chapter structure, introduction and conclusion, visual aids, smooth transitions, emphasis on key points, review and practice, and an index. These e-books are particularly beneficial for educational and instructional materials, technical guides, and non-fiction books, providing a structured learning experience that enables readers to understand complex information more easily and retain knowledge effectively.

Theoretical Framework

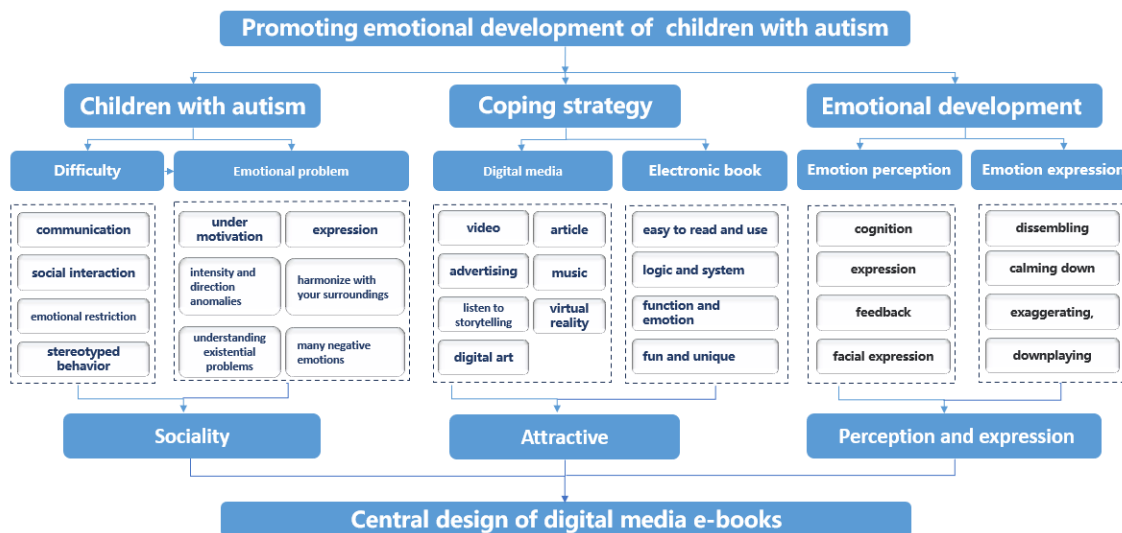


Figure 1.0: Theoretical Framework

The theoretical framework concludes that these traditional multimedia systems are repetitive, predictable, use real-time monitoring and feedback, and include many features (e.g., animation and game-based activities), which are engaging for children with ASD as well as easing the workload of practitioners and parents. However, most computer-based interventions lack natural interaction scenarios to engage younger children with limited hand-eye. Natural activities and inclusive environments are often necessary to support learning in

children with ASD, especially when newly acquired capacities are practiced as the children learn to share their intentions and emotional states with others in natural interactive contexts and repetitive activities. Otherwise, children with ASD may still have difficulties making facial expressions by themselves.

Conceptual Framework

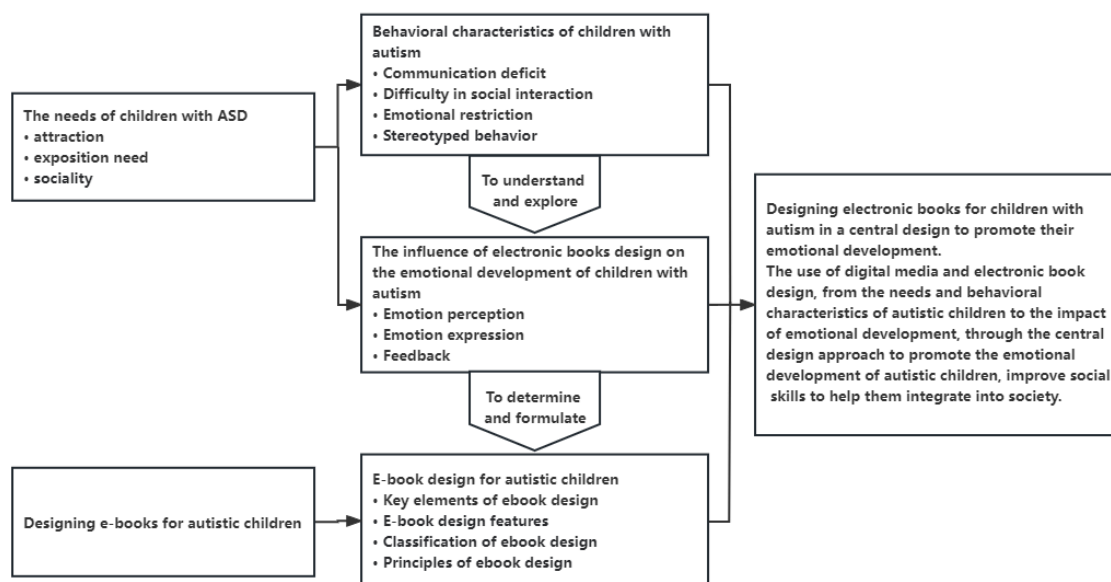


Figure 2.0: Conceptual Framework

The conceptual framework highlights the needs of the children with autism, which are improving their emotional development, and they require an e-book design with their behavioral characteristics. The broaden-and-build theory of positive emotions suggests that positive emotions play a crucial role in promoting emotional well-being. Positive emotions broaden attention and cognition, leading to upward spirals of increased emotional well-being. Positive affect and broad-minded coping have been found to predict each other reciprocally and prospectively, highlighting the importance of fostering positive emotions in children with autism to support their emotional development and well-being.

Conclusion & Recommendations for future research

Emotional development in children with autism is a crucial area of research, as they may exhibit unique patterns of emotional responses and struggle with perceiving and expressing emotions appropriately. These difficulties can impact their social interactions and overall well-being. A study in Surabaya.

A training program based on the theory of mind was found to improve emotional discrimination skills in children with ASD, adding to the limited literature on emotional discrimination in children with ASD. The challenges faced by children with ASD in schools and the role of school social workers in supporting them are discussed, emphasizing the importance of understanding the unique needs of children with ASD and the role of school social workers in providing individual and group counseling, family support, and collaboration with teachers and professionals.

Recognizing emotions is essential for social interaction, and several proposals have been presented to improve emotional skills in individuals with ASD. Technology, such as computer games, has been suggested to enhance emotional recognition skills in individuals with ASD. Overall, emotional development in children with ASD is a multifaceted area of research, focusing on various aspects such as NSSI, emotional discrimination, challenges in school settings, and interventions to improve emotional skills.

Significant and Benefits of Study

There appears to be a practical knowledge gap in the prior research. There is a lack of rigorous research in the prior literature. Some of these unexplored debates on e-book design principles for children with autism appear to be lacking in the practice of emotional development. The field of e-book design principles for children with autism is ripe for an investigation of practice. This study suggested that digitized picture books are capable of influencing and correcting the behaviors of preschool-aged autistic children. Meanwhile, a design model that may benefit the behavior improvement of preschool-aged autistic children was provided. Positive feedback was received from both the children and the parents.

Therefore, through the method of literature review, the behavioral characteristics of autistic children are analyzed, and the relevant design theories of e-books are obtained. Through the literature review of the behavioral characteristics of autistic children, the emotional development of autistic children, and the design of e-books, the e-book design based on the behavioral characteristics of autistic children's emotional development characteristics is provided with theoretical support.

References

- Ahmed, K. (2022). An Interactive Philosophical Vision For Textbook Design To Increase Information Value.
- Alshirawi, M., Hajji, H. (2023). The effectiveness of a training program based on theory of mind in developing of emotional discrimination among children with autism spectrum disorder. *European Scientific Journal Esj*, 2. <https://doi.org/10.19044/esipreprint.2.2023.p64>
- Attali, Y., Burstein, J. (2004). Automated Essay Scoring With E-rater® V.2.0. ETS Research Report Series, 2(2004), i-21.
- Bandim, J., Ventura, L., Miller, M., Almeida, H., & Costa, A. (2003). Autism and möbius sequence: an exploratory study of children in northeastern brazil. *Arquivos De Neuro-Psiquiatria*, 61(2A), 181-185. <https://doi.org/10.1590/s0004-282x2003000200004>
- Barakova, E., and Lourens, T. (2010). Expressing and interpreting emotional movements in social games with robots. *Personal and Ubiquitous Computing*, 14(5), 457-467. <https://doi.org/10.1007/s00779-009-0263-2>
- Beno, M. (2021). The Advantages and Disadvantages Of E-working: An Examination Using An Aldine Analysis. *Emerg Sci J*, (5), 11-20.
- Bishop, S., Hus, V., Duncan, A., Huerta, M., Gotham, K., Pickles, A., ... & Lord, C. (2012). Subcategories of restricted and repetitive behaviors in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 43(6), 1287-1297. <https://doi.org/10.1007/s10803-012-1671-0>

- Charman, T., Swettenham, J., Baron-Cohen, S., Cox, A., Baird, G., Drew, A. (1997). Infants With Autism: An Investigation Of Empathy, Pretend Play, Joint Attention, and Imitation.. *Developmental Psychology*, 5(33), 781-789.
- Choi, Y., Mai, D. (2018). The Sustainable Role Of the E-trust In The B2c E-commerce Of Vietnam. *Sustainability*, 1(10), 291.
- Clark, J., Saucedo, J., Stormes, S. (2019). Faculty Format Preferences In the Performing Arts: A Multi-institutional Study. *C&RL*, 4(80), 450-469.
- Dantas, A. C., Nascimento, M. Z. D. (2022). Recognition Of Emotions For People With Autism: An Approach To Improve Skills. *International Journal of Computer Games Technology*, (2022), 1-21.
- Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., ... & Varley, J. (2010). Randomized, controlled trial of an intervention for toddlers with autism: the early start denver model. *Pediatrics*, 125(1), e17-e23. <https://doi.org/10.1542/peds.2009-0958>
- Dawson, G., Toth, K., Abbott, R., Osterling, J., Munson, J., Estes, A., ... & Liaw, J. (2004). Early Social Attention Impairments In Autism: Social Orienting, Joint Attention, and Attention To Distress.. *Developmental Psychology*, 2(40), 271-283.
- Dillon, A., Gabbard, R. (1998). Hypermedia As An Educational Technology: a Review Of The Quantitative Research Literature On Learner Comprehension, Control, And Style. *Review of Educational Research*, 3(68), 322-349.
- Dinstein, I., Pierce, K., Eyer, L., Solso, S., Malach, R., Behrmann, M., ... & Courchesne, E. (2011). Disrupted neural synchronization in toddlers with autism. *Neuron*, 70(6), 1218-1225. <https://doi.org/10.1016/j.neuron.2011.04.018>
- Downs, A., and Smith, T. (2004). Emotional understanding, cooperation, and social behavior in high-functioning children with autism. *Journal of Autism and Developmental Disorders*, 34(6), 625-635. <https://doi.org/10.1007/s10803-004-5284-0>
- Fedushko, S., Ustyianovych, T. (2022). E-commerce Customers Behavior Research Using Cohort Analysis: a Case Study Of Covid-19. *Journal of Open Innovation: Technology, Market, and Complexity*, 1(8), 12.
- Golan, O., and Baron-Cohen, S. (2006). Systemizing empathy: teaching adults with asperger syndrome or high-functioning autism to recognize complex emotions using interactive multimedia. *Development and Psychopathology*, 18(02). <https://doi.org/10.1017/s0954579406060305>
- Hobson, R. (1986). The Autistic Child's Appraisal Of Expressions Of Emotion. *J Child Psychol & Psychiat*, 3(27), 321-342.
- Hughes, C., Bernstein, R., Kaplan, L., Reilly, C., Brigham, N., Cosgriff, J., ... & Boykin, M. (2013). Increasing conversational interactions between verbal high school students with autism and their peers without disabilities. *Focus on Autism and Other Developmental Disabilities*, 28(4), 241-254. <https://doi.org/10.1177/1088357613487019>
- Kaabachi, S., Mrad, S., Fiedler, A. (2019). The Moderating Effect Of E-bank Structure On French Consumers' Trust. *IJBM*, 2(38), 501-528.
- Kapp, S., Steward, R., Crane, L., Elliott, D., Elphick, C., Pellicano, E., ... & Russell, G. (2019). 'people should be allowed to do what they like': autistic adults' views and experiences of stimming. *Autism*, 23(7), 1782-1792. <https://doi.org/10.1177/1362361319829628>
- Kasari, C., and Smith, T. (2013). Interventions in schools for children with autism spectrum disorder: methods and recommendations. *Autism*, 17(3), 254-267.

- Koegel, R., Koegel, L., & McNERNEY, E. (2001). Pivotal areas in intervention for autism. *Journal of Clinical Child & Adolescent Psychology*, 30(1), 19-32.
- Landa, R., and Kalb, L. (2012). Long-term outcomes of toddlers with autism spectrum disorders exposed to short-term intervention. *Pediatrics*, 130(Supplement_2), S186-S190. <https://doi.org/10.1542/peds.2012-0900q>
- Macks, R., and Reeve, R. (2006). The adjustment of non-disabled siblings of children with autism. *Journal of Autism and Developmental Disorders*, 37(6), 1060-1067.
- Mazurek, M., and Kanne, S. (2010). Friendship and internalizing symptoms among children and adolescents with asd. *Journal of Autism and Developmental Disorders*, 40(12), 1512-1520. <https://doi.org/10.1007/s10803-010-1014-y>
- McConachie, H. (2006). Joint attention and symbolic play in young children with autism: a randomized controlled intervention study. *Child Care Health and Development*, 32(6), 752-752. https://doi.org/10.1111/j.1365-2214.2006.00706_2.x
- Mesibov, G. and Shea, V. (2009). The teacch program in the era of evidence-based practice. *Journal of Autism and Developmental Disorders*, 40(5), 570-579. <https://doi.org/10.1007/s10803-009-0901-6>
- Ohtake, Y., Takahashi, A., Watanabe, K., 2015. Using an Animated Cartoon Hero in Video Instruction to Improve Bathroom-Related Skills of a Student with Autism Spectrum Disorder. *Educ. Train Autism. Dev. Disabil.* 50, 343–355.
- Pellegrini, C., Steglitz, J., & Hoffman, S. (2014). E-health intervention development: a synopsis and comment on “what design features are used in effective e-health interventions? a review using techniques from critical interpretive synthesis”. *Translational Behavioral Medicine*, 4(4), 342-345. <https://doi.org/10.1007/s13142-014-0283-y>
- Petalas, M., Hastings, R., Nash, S., Lloyd, T., & Dowey, A. (2009). Emotional and behavioural adjustment in siblings of children with intellectual disability with and without autism. *Autism*, 13(5), 471-483.
- Pontoh, G., Linting, I., & Syamsuddin, S. (2021). The effectiveness of e-learning system with design features as mediating variable. *Journal of International Conference Proceedings*, 4(2). <https://doi.org/10.32535/jicp.v4i2.1224>
- Ragan, A., Kammer, J., Atkins, C., & Burrell, R. (2019). Learning to read online: the effect of instruction on e-textbook use. *Library Hi Tech*, 37(2), 293-311. <https://doi.org/10.1108/lht-01-2018-0011>
- Reed, P. (2023). Individuals With Autism Spectrum Disorder Are Differentially Sensitive To Interference From Previous Verbal Feedback. *Autism*, 136236132211503.
- Reichow, B. and Wolery, M. (2008). Comprehensive synthesis of early intensive behavioral interventions for young children with autism based on the ucla young autism project model. *Journal of Autism and Developmental Disorders*, 39(1), 23-41.
- Rieffe, C., Terwogt, M., & Kotronopoulou, K. (2006). Awareness of single and multiple emotions in high-functioning children with autism. *Journal of Autism and Developmental Disorders*, 37(3), 455-465. <https://doi.org/10.1007/s10803-006-0171-5>
- Scambler, D., Hepburn, S., Rutherford, M., Wehner, E., & Rogers, S. (2006). Emotional responsivity in children with autism, children with other developmental disabilities, and children with typical development. *Journal of Autism and Developmental Disorders*, 37(3), 553-563. <https://doi.org/10.1007/s10803-006-0186-y>
- Sigman, M., and Ungerer, J. (1984). Attachment behaviors in autistic children. *Journal of Autism and Developmental Disorders*, 14(3), 231-244.

<https://doi.org/10.1007/bf02409576>

- Sigmon, M., Tackett, M., & Azano, A. (2016). Using children's picture books about autism as resources in inclusive classrooms. *The Reading Teacher*, 70(1), 111-117.
- Smith, E., and Bennetto, L. (2007). Audiovisual speech integration and lipreading in autism. *Journal of Child Psychology and Psychiatry*, 48(8), 813-821.
- Tager-Flusberg, H., and Joseph, R. (2003). Identifying neurocognitive phenotypes in autism. *Philosophical Transactions of the Royal Society B Biological Sciences*, 358(1430), 303-314.
- World Health Organization. (2019). Autism.
- Zhao, Y., Zhang, J., & Wu, M. (2019). Finding users' voice on social media: an investigation of online support groups for autism-affected users on facebook. *International Journal of Environmental Research and Public Health*, 16(23), 4804.