

Accessibility of e-books for Secondary School Students in Ireland and Cyprus



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Abstract Across the EU, an increasing number of second-level schools are using digital materials (Baron in *How we read now: Strategic choices for print, screen, and audio*. Oxford University Press, 2021; Hsieh and Huang in *Educ Inf Technol* 25:1285–1301, 2020). Such resources must be inclusive and accessible (Marcus-Quinn and Hourigan in *Irish Educ Stud* 41:161–169, 2022). Accessibility is paramount if students, particularly students confronting disabilities or learning impediments, are to experience equitable educational outcomes. While a multitude of school textbooks presently offer electronic book (e-book) alternatives, tailored for download and engagement via digital platforms, a significant number of these lack purposeful adaptation for online dissemination, thereby undermining their optimal accessibility. Some studies of e-book use at third level have found that undergraduate students notice accessibility features that e-books do not offer, such as customization of text display, the facility to highlight and annotate text, or the inclusion of interactive features such as embedded media content (Pierard et al. in *Undesirable difficulties: investigating barriers to students' learning with e-books in a semester-length course*, 2019). There have been few similar studies for other education sectors. Accessibility features play a crucial role in making the digital learning experience more successful and also help students succeed in their studies. This chapter discusses the imperative of accessibility in the context of e-books specifically produced for the second-level education sector in both Ireland and Cyprus. The chapter will explore accessibility

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features common to many school e-books and highlight problematic issues associated with e-books that have not been prepared with accessibility considerations as part of the publication process.

Keywords Accessibility · Equity · e-books · Education · Schools

1 Introduction

The transformation in the materiality of textbooks requires a redefinition of their significance and a substantial evolution in teaching and learning methodologies. It is imperative that all stakeholders involved in the design, production, and consumption of e-books and digital teaching and learning materials investigate, as technologies evolve, how learners can best engage with the text (Kepic Mohar, 2020). Digital materials are being used in post-primary level education in both Ireland and Cyprus. Digital material, including e-books, is produced in both a formal context (publishers with a formal publication process and quality checks) and an informal context (teachers producing digital content). Each context has problems associated with it. Our goal in this chapter is to analyze the current situation and discuss how we can support educators in the two countries to create accessible digital content. This chapter suggests some solutions that may help in generating and creating better, more accessible digital material and e-books. In this chapter, we discuss the data made available by the Department of Education (Cyprus) and similar data available in Ireland. We discuss issues around accessibility that teachers have reported in their community. We also examine the issues that can arise from teachers creating their own content and what teachers as content creators can do to try and overcome these barriers and create accessible digital content and e-books.

2 e-books in Education

There is a growing body of research in recent years which looks at the use of e-books in educational settings. Some studies have suggested that to increase the availability of e-books, the production process will need to evolve from current manual methods to a more automated system. Automating the process would facilitate publishers in maintaining a consistent brand across a digital library's collection or creating customized editions for particular audiences (Carrizo et al., 2005; Lopes et al., 2006). A study carried out by Almekhlafi (2021) on the effect of e-books on preservice student teachers' achievement and perceptions in the United Arab Emirates (UAE) has made several recommendations for all stakeholders including the Ministry of Education. Some of these recommendations are specific to the UAE, but some could be considered by other Departments of Education and Ministries of education. These include the provision of comprehensive professional development

and training for teachers which is focused on the effective development and use of e-books. The study also recommends that the education sectors forge partnerships with reputable publishing companies and that schools be equipped with the necessary technological infrastructure which is crucial for the effective use and accessibility of e-books for all students. In 2023, a study exploring the impact of traditional materials versus electronic textbooks (via mobile applications) on English vocabulary development among university students also examined the benefits and challenges of using mobile devices. This study found that using e-books on mobile devices was effective in enhancing vocabulary learning in both short and long terms, with benefits including episodic learning, easy access to materials, and increased motivation, but faced challenges like health concerns and distractions from other apps. Despite limitations such as the inability to control for all variables and the focus on only one aspect of vocabulary knowledge, the study provides evidence that electronic textbooks on mobile devices can significantly improve vocabulary learning in EFL students. However, the authors suggest the need for further research to explore the broader impacts of mobile-assisted vocabulary learning across different demographics and learning contexts (Xodabande & Hashemi, 2023). It is clear that more research is necessary to identify the potential limitations and benefits of incorporating e-books into the teaching and learning environment.

3 The Use of e-books and Digital Materials in Ireland and Cyprus

As more secondary schools across the EU begin to integrate e-books into their curriculum, accessibility should play a critical role in the decisions made. Ensuring that digital textbooks are accessible aids every student. Accessibility features which promote inclusivity, flexibility, and personalized learning result in better academic results and a fairer learning environment for all students (Marcus-Quinn, 2022; Marcus-Quinn et al., 2022). In this chapter, our analysis is based on information shared by the education community in Ireland and primary survey data collected in Cyprus. This approach was adopted due to the wealth of relevant discussions, opinions, and information shared online, which provided valuable perspectives for our analysis. Using both this publicly available data and the targeted survey data allowed us to include both countries in our study, ensuring a broader comparative scope, while acknowledging the methodological differences in data collection between the two countries. This strategy highlights the adaptability of our research design to navigate the varied landscapes of data availability and accessibility in different geographical contexts.

In Ireland, there are various publishers and platforms that offer e-books tailored for educational purposes. Some popular publishers for second-level schools include Edco, Folens, and CJ Fallon. In recent years, these publishers have started to offer digital versions of many of their textbooks. The e-book may not be specifically

designed for online consumption and may be a PDF version of the hardcopy book. The majority of school textbooks available as e-books come with a single-user license. Some publishers offer a direct download after purchase, while others may provide access through a specific platform or app. Some publishers will have their own platforms or apps where students can access the purchased e-books, and this includes additional interactive features, resources, and updates. When selecting an e-book, teachers should be able to check the level of compatibility with assistive technology. This entails verifying that the e-book integrates seamlessly with widely used assistive tools such as screen readers, braille displays, and voice recognition systems. A challenge arises when an e-book, associated with a school textbook, is merely a PDF replica of the print version without any advanced accessibility or interactive features (Marcus-Quinn, 2024). Typographic choice is an example of an issue that will significantly impact the usability of an e-book as typographic variations should be determined based on whether the material will be consumed hardcopy or electronically. One such issue concerns the display of italicized text, especially when combined with bold. Many fonts struggle to correctly render a Bold Italic style, which is often used for emphasis, highlighting quotations, referencing older texts, or indicating foreign words. This becomes notably problematic in History e-books where such emphasis is used more frequently.

Historically, accessibility solutions provided by publishers in Ireland have been tailored to individual needs. For instance, if a student needed an accessible version of a course text, they would request it through their teacher. “Accessible” usually implies a text modified to cater to the student’s specific requirements. Educational and academic textbook publishers represented by the Irish Educational Publishers’ Association (IEPA) handle these needs individually. While publishers strive to meet all requests, they cannot always promise the availability of a specific title or format, but they have established procedures to cater to these accessibility demands, often providing customized textbooks for students with special needs. However, this process requires significant administrative effort for both those requesting the service and those providing a solution. For example, if a student or their parent/guardian wishes to acquire an accessible text from the IEPA, the IEPA’s centralized Special Needs Access Policy necessitates both parental permission and confirmation from the school’s principal for the student in question. The steps for acquiring accessible texts include:

1. Filling out the IEPA Special Needs Access Request Form available on the IEPA Web site at <https://iepa.ie/>.
2. Submitting this form to the appropriate publishers via the listed email addresses (given that multiple educational publishers exist in Ireland).
3. The relevant publisher will communicate the conditions for access, including payment, proof of purchase, copyright agreements, and data retention policies.
4. Once the prior steps are completed, the student will receive the files or access.

Similar processes are also employed in other EU member states to obtain accessible e-books.

Many publishers do not have a central online facility to gather feedback from teachers and students about the effectiveness and usability of e-books. A central facility would enable publishers to capture usability more effectively and would help in making better informed design decisions in future and would also allow them to optimize the learning experience for all students.

4 Cyprus

In accordance with extant directives issued by the Cyprus Ministry of Education, Sport, and Youth, educational materials, specifically textbooks, are presently distributed to students in a printed format. Within the framework of the Cyprus Educational System, books used include materials from the Curriculum Development Unit (C.D.U./M.O.E.C.), the Greek Agency for Publishing School Textbooks (O.E.B.Δ.), and various alternative sources. The graphical representation below is the total number of books used at all levels of education (Fig. 1).

Concurrently, an electronic version in Portable Document Format (PDF) is accessible for download via the Ministry’s Educational Portal (<https://schools.ac.cy/>). Supplementary materials, including supporting documentation, presentations, applications, simulations, and analogous content, are also disseminated through subject-specific webpages. Notably, the instructional manuals and publications originating from the Cyprus Ministry of Education, Sport, and Youth are presently unavailable in electronic book (e-book) format, at least within the current operational framework. A small number of books are posted on the Web site of CTI in the form of e-books and, consequently, are also accessible to teachers in Cyprus as Interactive School Books,

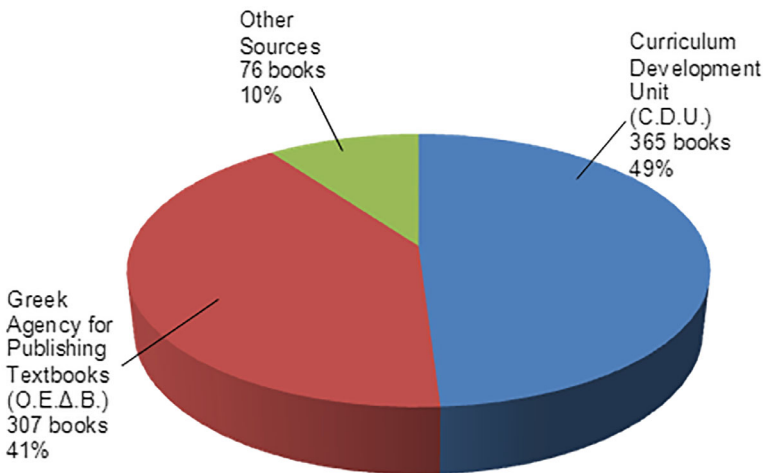


Fig. 1 The total quantity of books utilized in Cyprus education system at all levels

of which the materials are categorized by class or subject (<http://eBooks.edu.gr/eBooks/>). In the context of their teaching, teachers may use e-books obtained from other sources as a means of enriching a lesson. However, there is no reliable data (e.g., research) at this point that records the degree of usability and accessibility or the ways of pedagogical utilization of e-books by the teachers in Cyprus (Table 1).

As teachers in Ireland have complete autonomy in terms of where they source their textbooks (hardcopy and e-books), it is almost impossible to conduct a direct comparison with the context in Cyprus. The process by which teachers choose their textbooks can vary by school and is typically influenced by several factors, including curricular requirements, school policy, teacher preference, resource evaluation, budget considerations, and student needs. However, the majority of Irish schools using traditional books will use the online bookshop schoolbooks.ie an Irish online retailer that specializes in the sale of schoolbooks and educational materials. Teachers will also use digital resources available from Scoilnet.ie; Scoilnet is the Department of Education's official portal for Irish education and was originally launched in 1998. The Web site is currently managed by Oide Technology in Education on behalf of the Department of Education. Scoilnet collaborates with practicing teachers to maintain and manage the content on the Web site (Table 2).

Table 1 The set of student's textbooks for the 2021–2022 school year and their sources (Cyprus)

Education level	Number of book titles			
	C.D.U.	CTI	Other sources	Total
Elementary/pre-primary	101	40	–	141
Secondary general education	154	63	26	243
Secondary technical vocational education and training	183	149	8	340
Total	438 (60.5%)	252 (34.8%)	34 (4.7%)	724 (100%)

Table 2 The school books and teaching materials available from Scoilnet for the 2022–2023 school year (Ireland)

Education level	Number of book titles			
	Schoolbooks.ie	Scoilnet resources	Teacher resources Schoolbooks.ie	Total
Elementary/pre-primary	1790	15,042	13	16,845
Secondary junior cycle	570	6381	2	6953
Secondary senior cycle (leaving certificate)	567	8530		9097
Total	2,927	29,953		32,880

5 The Education Community

The international education community collaborates extensively to support the use of digital materials and e-books, fostering a network of shared knowledge and resources. Educators worldwide exchange best practices and innovative teaching strategies through online platforms, webinars, and international conferences. Online forums and professional learning communities offer spaces for teachers to discuss challenges and solutions in integrating technology into the classroom. The next section discusses the use of e-books in both Ireland and Cyprus.

6 Ireland

The education community in Ireland is very solution-focused as is evidenced by the nature and frequency of the online discourse relating to digital resources for teaching and learning in schools. The Computers in Education Society of Ireland (CESI) is an organization dedicated to the advancement of computers in education. It was formed in 1973, and its mission is to support teachers and educators in integrating technology effectively into teaching and learning processes. The online community of CESI is quite active and serves as a platform for educators across Ireland to share resources, experiences, and ideas related to using technology in education. The CESI mailing list provides support and answers to common questions. While CESI has a specific focus on fostering a community around the use of technology in education, the professional service branch of the Department of Education offers a more structured and comprehensive range of professional development services across all areas of teaching and learning, including curriculum support and implementation. CESI's approach is more community-driven and informal, based on the sharing of ideas and experiences, while Oide provides formal training and resources, aligned with national educational policies and goals.

7 Challenges Associated with e-books and Digital Materials in Ireland

Every August, as schools reopen after the summer break, members of various online discussion groups within the education community, including CESI, share their experiences of how they have managed problems with technology. The purpose of the discussion list managed by the CESI is to facilitate discussion of the ICT issues faced by teachers in schools in Ireland. Anyone on the web can view these discussions. Discussions in recent years have focused on digital resources including e-books and supplementary materials provided by publishers to primary school classes. At the

start of the last academic year, members discussed the prevailing challenges relating to e-books as outlined in the section below.

Members discussed the potential value of having one central repository/access point to all e-books. They referred to the ongoing proposition for Irish publishers to transition to a unified app for all e-books. However, despite being proposed repeatedly over the past two decades, this idea has not been realized, indicating a clear lack of inclination from publishers to consolidate e-book offerings in one application. It is indeed difficult to understand why school textbooks cannot be made accessible in a manner analogous to standard e-books. Where such a transition has been made access and distribution have been streamlined, thereby enhancing the user experience for a wide array of users (Cooke, 2017; Scott et al., 2022).

Accessibility features of e-books are also discussed in terms of the challenges posed. At a minimum, users expect to be able to adjust fonts, themes, and reading modes according to their needs and preferences. Many users are using a diverse range of devices to access the material and expect digital material and e-books to be optimized for various devices with responsive design factored in from the beginning of the design and development process to allow users to access material on various devices, including tablets, smartphones, and e-readers (Clark & Mayer, 2016).

Members of many education Communities of Practice regularly complain that e-books are platform agnostic and are not accessible and fully functional across different e-book platforms and operating systems or that content is only available online and cannot be accessed off-line. During the pandemic, university libraries had to overcome barriers in delivering digital materials including e-books, and the lessons learned from this activity should now impact how access to material can be managed at second level (Whitfield et al., 2021). Users expect to be able to download e-books to read at their convenience. It is also often the case that teachers can only access a publisher's app via the computer that they have downloaded it to with an assigned login provided by the publisher. This login is unique to each teacher. Therefore, if a teacher is unexpectedly absent and has their laptop at home, a substitute teacher cannot access the app on another device.

Members of this education community also frequently highlight the challenges associated with the licensing of e-books. Digital Rights Management (DRM) technologies prevent the unauthorized copying and distribution of e-books. However, this can limit legitimate uses, such as sharing an e-book with students or transferring it to different devices for classroom use. There is little in the research literature pertaining to perpetual licenses at second level, but there is research published which highlights and discusses issues with such licenses at third level (Bullock, 2014). Some schools have purchased a perpetual license, and when they experience problems, they cannot cancel their subscription.

Obsolete technology is also often discussed in the online spaces. In the late 1990s, many teachers started to incorporate material from CD ROMs into their teaching practice (Glasgow, 1997; Shamir & Korat, 2006). Many language hardcopy books are still sold with a CD ROM despite many households not having any compatible hardware to play the audio material. Similarly, when digital schoolbook publishing was in its nascent stages, several publishers opted to design their books using Flash.

However, Adobe officially discontinued Flash at the end of 2020, ceasing updates and distribution of the Flash Player (Keizer, 2017). The obsolescence of Flash means that any teaching materials (like interactive web applications, animations, or multimedia content) that were created using Adobe Flash may no longer be accessible or functional on modern devices and browsers. Educators and institutions have had to update or replace these materials with alternatives that use more modern and supported technologies.

Research on interactivity and e-books is growing. Some studies exploring young children's educational experiences with e-books indicate that straightforward, repetitive interactive elements within e-books, which keep the reader engaged in the narrative, neither significantly aid nor hinder learning (Etta & Kirkorian, 2019). There are many examples where the e-book is essentially a PDF version of their printed book with little or no interactivity, annotation options, audio or video. Book publishers can enhance their e-book offerings in various ways to make them more appealing, user-friendly, and competitive in the rapidly evolving digital marketplace. The expectations that educators and end users have of e-books have grown in recent years, and people now expect an enhanced user experience with interactive features. Users of e-books expect to be offered integrated interactive elements such as multimedia, hyperlinks, and quizzes to engage readers better. Depending on the subject matter, users also expect that digital content will incorporate audio, video, and visual content to enrich the reading experience. Many users would also like to see improved search functionality and ease of navigation within e-books.

Separate to these issues, parent representatives regularly take to the media to complain about the business model and pricing of e-books. For many students, the e-book that accompanies the hardcopy book can only be accessed once using a code printed on the inside cover of the hardcopy book. The code usually has a timed expiry (often three years). This means that e-books cannot be shared with younger siblings. Many parents are highly critical of this practice and believe that e-books should be priced more competitively, considering the lack of printing and distribution costs.

8 Cyprus

As mentioned earlier in this chapter, in Cyprus, there is a gap in research on the accessibility of e-books for secondary education; consequently, to address this need, primary research was undertaken, drawing upon insights furnished by educational staff in Cyprus. The acquisition of survey data has facilitated the discernment of the applicability of the research framework in negotiating diverse geographical settings wherein data may be scarce or challenging to access.

The assimilation of e-books is becoming increasingly important in modern educational methods in Cyprus, as it is in many other places around the world. e-books offer numerous advantages, such as portability, interactivity, and accessibility, which have revolutionized how students engage with educational materials. However, ensuring that all students, including those with special needs, have equal access to e-books is

still a significant concern in Cyprus' education sector. There is widespread recognition in Cyprus of the transformative potential of e-books in enabling learning experiences that go beyond traditional boundaries.

There is a visible increase in the use and recognition of the advantages of e-books in the educational sector of Cyprus. Majority of the educators are now incorporating e-books into their teaching methods, indicating the widespread acceptance of digital learning resources in Cyprus's educational institutions. Additionally, e-books are highly favored for their ability to enhance accessibility for students with special needs. The flexibility and versatility of e-books are considered highly valuable, as they enable educators to cater to the varied learning styles and requirements of their students. The positive attitude toward e-books in Cyprus demonstrates their potential as an effective tool to improve the quality of education and promote inclusivity in the learning environment.

Despite the widespread recognition of the benefits associated with e-books, there are still challenges when it comes to accessing them. One of the main issues is the difficulty of accessing e-books across different online platforms. This highlights the need for streamlined access mechanisms to make e-books more widely available. Another important consideration is to incorporate flexible and adaptable design features into e-books to ensure that everyone, regardless of their abilities, can access them. These challenges emphasize the need for proactive measures to enhance e-book accessibility in Cyprus. It is important to address these issues to promote inclusivity and ensure that all students have equal access to educational resources.

In Cyprus, there is a significant need for training seminars that can provide educators with the necessary skills to integrate e-books effectively into their teaching practices. This requires the creation of specialized spaces with suitable technological infrastructure that can facilitate easy access and utilization of e-books. Additionally, it is crucial to ensure that students have access to electronic devices and continuous internet connectivity to enhance their access to e-books. These efforts are essential in promoting inclusivity and equal access to educational resources for all students.

Educators in Cyprus have reached a consensus about the importance of having e-book licenses available at their institutions. However, there is a need for clearer guidelines and support structures to facilitate the procurement and licensing of e-books, ensuring accessibility for all students. It is essential to continuously improve accessibility challenges to maintain the efficacy of e-books as educational tools. These actions are necessary for promoting educational equity and enhancing learning outcomes in Cyprus.

In conclusion, the use of e-books in education is highly valued in Cyprus, particularly for its potential to create inclusive learning environments. However, to fully realize this potential, there are challenges that need to be addressed such as accessibility issues and providing adequate training and support for both educators and students. This is especially important to ensure that individuals with special needs have equal access to educational resources. By implementing the recommendations of stakeholders and committing to continuous improvement, educational stakeholders in Cyprus can harness the power of e-books to enhance learning experiences and promote educational equity and inclusion across diverse student populations.

9 Challenges Associated with e-books and Digital Materials in Cyprus

Teachers who incorporate e-books into their lessons often encounter the challenge of ensuring accessibility for students with special needs. They also emphasize the significance of a flexible and adaptable design for e-books, positively influencing their educational value. Many teachers adjust font size or color, signaling dissatisfaction with the default settings. It is noteworthy that schools or institutions play a pivotal role in providing digital resources and e-books, with over half of the teachers indicating that their respective institutions possess licenses for online book usage. However, a considerable number of teachers remain unaware of whether their institutions hold such licenses, underscoring the need for more information about the availability of digital resources within the educational community.

For teachers who abstain from using e-books, the primary obstacle appears to be a lack of familiarity with new technologies, implying a need for teacher training. Nonetheless, the incorporation of e-books can render teaching more engaging for students by fostering increased interactivity in the classroom. The accessibility of e-books for students with special needs is also crucial, highlighting the necessity for equal access to educational materials. The majority of respondents agreed that an educational platform offering e-books across all subject areas, especially for students with special needs, would be exceedingly useful and beneficial.

The importance of a flexible and adaptable design for e-books is emphasized to meet the diverse needs of readers. Nevertheless, challenges in accessing various platforms persist, with a notable percentage of teachers reporting that they have not experimented with them. Many teachers remain uncertain about the existence of licenses for e-books in schools and institutions. Finally, teacher training emerges as a crucial component for the effective support of students with special needs through the utilization of e-books.

10 Designing for Accessibility in e-books

Publishers can maximize accessibility in e-books by incorporating features like adjustable text sizes, alternative text for images, and screen reader compatibility to cater to diverse needs, including those of visually impaired readers. Additionally, ensuring compatibility with various platforms and devices, and providing options for customizable layouts and text-to-speech functions, can greatly enhance the usability and inclusiveness of digital reading materials. Some publishers have developed bimodal-bilingual e-books to enhance accessibility. Both theoretical and practical evidence supports the idea that early exposure to sign language (SL) through effective teaching methods enhances the written literacy of deaf children (Clark & Mayer, 2023; Cooper et al., 2020; Joy et al., 2021). The RISE e-book, a collaborative effort between Gallaudet University and Swarthmore College (Cooper et al., 2020), is a

bilingual-bimodal project aimed at promoting reading. This e-book offers classic children's books and incorporates sign language to create a shared reading experience for deaf children and their parents. Presently, the e-books are accessible in American, Korean, Nepali, Fiji, Japanese, and Brazilian sign languages. Mirus and Napoli's research (2018) has highlighted the efficacy of bimodal-bilingual e-books for both deaf children and hearing adults (Mirus & Napoli, 2018). They emphasized the growing demand for bimodal-bilingual e-books for recreational purposes, fostering pre-literacy skills, and the necessity for educational e-books tailored for academic knowledge acquisition. Mirus and Napoli have highlighted the limited availability of such e-books.

The GLOSSING system involves representing signs in written form using capital letters (and other indicators for pointing signs, classifiers, etc.) to convey the meaning of each sign in accordance with GSL syntax (Joy et al., 2021). The same methodology is applied to fairytales, oral stories, and picture stories. All printed materials can be accessed in PDF or in HTML formats on the official Web site of the Publishing House of the Department of Education "ITYE Diofantos" <http://eBooks.edu.gr/new/allmaterial.php>. Textbook content is organized into meaningful units, ranging from individual vocabulary items to sentence-level expressions for vocalization, presentation in Greek Sign Language (GSL), and incorporation of interactive subtitles. Materials for teaching GSL as a primary language utilize a simple GLOSSING system and are transcribed in both GSL and written Greek. By incorporating glossing in these ways, e-books can become more accessible to the deaf and hard of hearing community, ensuring that they have equal opportunities to access information and education.

Reading applications have also reached a sufficient level of maturity to support interactive EPUB 3; the standard for digital books and publications. EPUB3 enhances the capabilities of its predecessor (EPUB 2) by offering a richer reading experience and greater accessibility features, and the format could be instrumental in shaping the future of digital publishing, providing authors, publishers, and developers with the tools to create rich, interactive, and accessible digital reading experiences (Prasetya et al., 2020). However, screen reader assistive technology currently faces challenges in effectively interacting with multimedia and interactive EPUB 3 content as the interactive EPUB3 format is not yet fully compatible with apps and screen readers (Nakajima et al., 2013).

Veliz et al. conducted a study (Véliz et al., 2017) on the impact of sign language (SL) augmented digital books for deaf learners. Employing a participatory development model, preliminary findings suggest that enhancing SL-based instructions with books enhances comprehension. The Visual Language and Visual Learning (VL2) project at Gallaudet University developed a storybook application for mobile devices, augmenting SL content with English text to facilitate reading and language acquisition for early and emerging readers. In contrast, the SMARTSign project (Joy et al., 2021) is a mobile application used alongside physical books. Users can capture a picture of the story, and the SMARTSign AR mobile application automatically converts it into the corresponding sign. While not specifically focused on textbook learning, Hariharan, Al-hkhazraji, and Huenerfauth proposed a web-based tool (Hariharan et al., 2018) for translating words to American Sign Language (ASL) to enhance

accessibility. Initial results indicate that participants prefer having support tools in their interfaces compared to having none. This research introduces SignText, a web-based tool designed for learning textbook lessons in sign language. Findings suggest that learning through sign language improves students' scores compared to traditional textbook-based learning. Currently, SignText supports sign language-based learning for a limited number of lessons, with pre-recorded sign videos provided by instructors on the web page. Qualitative analysis indicates a preference among respondents for watching their instructor sign. Further investigation is needed to assess the effectiveness of signs produced by different signers within the SignText application. Presently, SignText only includes one chapter for learning, and expanding content may pose challenges for sign instructors. Thus, automating the content generation process could significantly benefit both instructors and students.

Regarding the young DHH (deaf and hard of hearing) children, research undertaken by Wauters and Dirks (2017) explored interactive storybook reading through e-books on tablets. Parents participated in a program to learn interactive reading strategies, such as asking open-ended questions and connecting stories to their child's personal experiences. The results, involving 18 DHH children aged one to three, revealed that parents engaged in similar interactive reading behaviors with both e-books and print books. The study concluded that e-books offer additional opportunities for interactive reading with DHH children, particularly noting the portability of tablets and their capacity to store a large collection of e-books. Similarly, Messier and Wood (2015) investigated the use of e-books with embedded vocabulary instruction for 18 children with cochlear implants (aged four to nine). The study found that using e-books with embedded vocabulary instruction, as opposed to traditional storytelling, resulted in greater benefits for expressive labeling, definition generation, and enhanced retention of expressive vocabulary.

Designing an accessible e-book for students with motor impairments is crucial for ensuring inclusivity in an educational content. Incorporating principles from the Web Content Accessibility Guidelines (WCAG) is foundational. Jankovic (2021) specified guidelines on keyboard accessibility which is essential, as it allows users with motor impairments to navigate the e-book seamlessly using only a keyboard, providing a comprehensive insights into creating a keyboard-accessible interface, emphasizing the importance of allowing users to operate the e-book without relying on fine motor skills.

To enhance accessibility further, publishers could consider integrating voice command options into the e-book. Voice-based interaction can be a valuable alternative for individuals with motor challenges, offering a hands-free method of navigating through content. Studies, such as "Voice-based Interaction in the Automobile: Understanding the Effects of Cognitive Load on Task Performance," emphasize the effectiveness of voice commands in reducing cognitive load and improving task performance, demonstrating the potential benefits for users with motor impairments (Cooper et al., 2020).

User testing also plays a crucial role in refining the design and ensuring its effectiveness for students with motor impairments. Engaging individuals with diverse motor abilities in the testing process provides valuable insights into the usability of

keyboard controls and voice command features. Resources like the Interaction Design Foundation's guidance on "Involving Users in the Design Process" emphasize the importance of user feedback in creating a more inclusive and user-friendly educational experience (Jankovic et al., 2021). Through a holistic approach that combines WCAG guidelines, voice command integration, and user testing, an accessible e-book can be crafted to meet the diverse needs of students with motor impairments.

Creating an accessible e-book for students with cognitive impairments involves thoughtful design to enhance comprehension and ease of navigation and the guidelines and recommendations established by Hashim et al. (2021) are very useful. For cognitive accessibility, it is important to emphasize clear and consistent presentation of information, adhering to guidelines on reading level and consistent navigation. These guidelines stress the importance of using plain language and organizing content in a way that minimizes cognitive load, making it more accessible for students with cognitive impairments (Hashim et al., 2021). Incorporating interactive elements that provide additional context and support understanding is another key aspect of designing for accessibility in e-books. Features such as tooltips or guided tutorials, which can assist students with cognitive challenges in grasping complex concepts can be exploited. This aligns with the WCAG principle of creating content that is not only perceivable but also understandable, ensuring that students with cognitive impairments can engage with the material more effectively (Shahzad, 2018).

Regular user testing involving individuals with cognitive impairments is also essential for refining the e-book's design. Obtaining feedback on the clarity of language, the effectiveness of interactive elements, and the overall usability of the e-book can guide iterative improvements. This user-centered design approach, supported by resources such as the Interaction Design Foundation's "Involving Users in the Design Process," emphasizes the importance of incorporating user feedback to create an e-book that truly meets the cognitive accessibility needs of diverse students (Sun et al., 2023). By implementing these principles and continually refining the design based on user insights, an accessible e-book for students with cognitive impairments can contribute to a more inclusive educational experience.

11 Conclusion

The global trend toward digitization in education, including the increasing use of e-books, has been steadily growing. The EU is developing and implementing initiatives to improve accessibility across all aspects of daily life for all EU citizens. The Web Accessibility Directive and numerous other projects work toward implementing a digital education strategy. This work involves promoting digital literacy and ensuring that educational materials are accessible digitally. E-books will be under much more scrutiny in the near future due to the European Accessibility Act.

This chapter underscores the vital importance of accessibility in the realm of digital educational materials, particularly e-books, for second-level education in

Ireland and Cyprus. The increasing reliance on digital resources in schools across the EU brings to the forefront the need for inclusivity and accessibility in educational content. As evidenced by the experiences of undergraduate students, the absence of essential accessibility features in e-books—such as text customization, annotation capabilities, and interactive media—can significantly impede the learning experience, especially for students with disabilities or learning challenges. This chapter highlights that while many school e-books incorporate some accessibility features, there remains a substantial gap in those not specifically designed with accessibility in mind. Addressing these shortcomings is not just about enhancing digital textbooks but is fundamentally about ensuring equitable access to education. Future efforts in the publication of educational materials must prioritize accessibility from the outset, ensuring that all students, regardless of their learning needs, have equal opportunities to benefit from the digital learning revolution.

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