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Learning Object Repository Systems and Their Use in Greek Education

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Abstract: *The article explores how modern information and communication technologies (ICT) enhance educational quality, emphasizing the importance of pedagogically sound applications to address the limitations of traditional educational systems. While ICT offers considerable benefits, such as increased engagement and support for collaborative learning, the integration of these technologies in education presents challenges, including disparities in access and shifts in learning methodologies. The concept of Open Educational Resources (OER) is highlighted as a transformative approach, allowing for the creation and sharing of diverse learning materials, which are crucial for promoting accessibility and equity in education.*

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Additionally, the article discusses organizational development issues that schools face when implementing ICT, such as the need for adaptive school cultures, leadership support, and the alignment of school policies with ICT goals. It also presents examples of digital repositories and open educational resources, like Project Gutenberg, ERIC, and MIT OpenCourseWare, which provide free access to educational materials. In Greece, national projects have introduced digital literacy into the school community, with repositories such as Photodentro LOR and Helios, supporting the country's commitment to digital education aligned with the European Digital Agenda.
Keywords: *Digital Educational Content, Information and Communication Technologies (ICT) Open Educational Resources (OER), Digital Literacy, Educational Innovation*

Introduction

The development of modern information and communication technologies (ICT) opens opportunities for enhancing the quality of education. When applied pedagogically, these technologies can revolutionize the educational process by helping to overcome the limitations of traditional, mass-replicative educational systems. On a humanistic level, updating and renewing educational policies presents a significant challenge for contemporary primary education, as it tests the pedagogical readiness of the system. Notable educational transformations are closely tied to the use of interactive, virtual, and networked information technologies, as well as advanced computers and high-speed Internet [1].

However, ICT alone is not a cure-all for the issues in education, as their integration presents challenges. According to experts, various issues arise when ICT is introduced into the educational process, often necessitating changes in the methodology and philosophy of learning. For example, if traditional, explanatory models of learning are maintained, face-to-face interaction is replaced by online communication, and traditional whiteboards and books are substituted with interactive boards and digital resources [2].

While ICT in schools can yield educational benefits, overcoming the challenges of ICT utilization is crucial to achieving these gains. Such challenges vary by school, region, and country. In developing nations, it is often believed that technological access and strong digital skills among citizens are essential for national prosperity [3].

Learning and teaching with ICT goes beyond memorization, enabling students to experience learning actively and enjoyably. ICT supports collaborative learning, facilitating both human-to-machine and human-to-human interactions. For example, web-based learning environments allow students to engage with teachers and peers through online communication [4].

Learning new technology is no harder than learning traditional skills, which is vital to understanding, as many people fear new technologies for their perceived complexity. In recent years, the idea of creating small, reusable pieces of educational content known as Open Educational Resources (OER) has taken root. OER enables educators to integrate diverse content into their courses and share it with others, eliminating the need to recreate existing materials and offering robust learning support [5].

These digital information pieces, called Learning Objects, come in various forms such as text, video, audio, graphics, and multimedia. They include simulations, lesson modules, case studies, and assessments. To enable accessibility, reusability, creativity, sharing, resilience, and scalability, advancements in metadata standards and Learning Object Repositories (LOR) continue to evolve [6].

OER has significant potential to offer universal and equitable access to education at all levels, enhancing the educational efforts of teachers. There is a vast and growing amount of digital learning resources available to students and educators through repositories, supporting educational transformation and accessibility worldwide [7].

1. Benefits of ICT in education

The benefits of ICT in education are such that all students in a classroom can access and learn from the curriculum content. Students with special needs are no longer at a disadvantage, as they have access to

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essential resources, and ICT tools can be tailored to meet their unique educational needs. However, this also raises new issues related to the "digital divide," as it provides access to ICT tools and resources for those who are less fortunate [8].

ICT brings students together, allowing them to discuss and share their schoolwork, which in turn fosters communication and the development of language skills. When ICT is integrated into lessons, students become more engaged in their work because technology offers various ways to make learning more enjoyable and engaging. As a result of this increased engagement, it is believed that students retain knowledge more effectively and efficiently [9].

ICT can influence students' learning methods, especially when teachers are digitally literate and know how to integrate it into the curriculum. Schools employ a variety of ICT tools to communicate, create, disseminate, store, and manage information, using students' smartphones or other devices for learning purposes [10].

ICT offers significant benefits in supporting learning. Through technology, students learn what information they need, why they need it, and how to obtain it. Active learning allows students to determine when specific information is necessary and to assess their understanding. This active learning also promotes independent learning [11].

Self-directed learning enables students to become motivated and autonomous learners who can quickly and effectively respond to ongoing information changes. For example, using blogs allows both educators and students to stay informed about educational and other topical discussions [12].

ICT also provides opportunities for dynamic and collaborative learning. With Internet access, learning is no longer limited by time or space, allowing students to access information anytime and anywhere. E-learning enables students to acquire information quickly and from various locations. Technology allows rural students to access urban resources and share knowledge with other students or teachers from the same region or even different countries. Besides dynamic learning, ICT enables all school staff to participate in collaborative learning and build learning communities [13].

Over the past few years, a global belief has emerged that ICT can enhance literacy. The effective use of ICT can improve students' literacy and numeracy skills. Students can enjoy and become excited about typing new words on a computer, which can also enhance their speaking and listening skills. This interaction occurs as they collaborate with peers, teachers, and parents or adults, where they listen to others and express their thoughts. Moreover, ICT supports reading skills as student's access stories online. Therefore, ICT plays a crucial role in enhancing literacy. Its usage not only supports students' cognitive development but also increases their motivation and interaction within the learning process [14].

2. Organizational Development Issues for ICT Implementation

The implementation of ICT in classrooms is not simply about bringing modern technology into schools or diminishing traditional classroom teaching. To make the use of ICT effective in education, several organizational aspects must be considered. These include school culture, the role of leadership, software/hardware selection, and school management systems [15].

Many schools reject ICT implementation because of a mismatch between the school's culture and the introduced software/hardware. The acceptance of new technology in a society depends on how well the proposed innovation aligns with the existing culture. It is crucial to understand the intended value that schools aim to impart to their students. Every technology embodies its own set of values. Therefore, a particular technology that is successfully implemented in one school may not necessarily be successful in another. Besides compatibility with school culture, schools must also foster an adaptive culture. Such a culture enables an organization to be ready to embrace constructive change within itself [16].

Another issue is the support of school leaders, who have the power to influence whether teachers and other staff members accept or reject a particular technology. Effective ICT implementation does not solely depend on the type of software but rather on how educators are empowered and motivated to use

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the software/hardware. The person who can empower and influence them is the school leader. Therefore, gaining the support of leaders is critical. Principals and administrators are expected not only to support ICT implementation but also to lead staff in its adoption, learning, and application. They must also be willing to learn the introduced software/hardware and demonstrate to teachers how to embrace new technology [17].

The ethical concerns surrounding the use of technology in education are also significant. Schools are considered places for fostering moral integrity. Another important issue is student involvement in maintaining computer facilities. Many students do not take care of computers, leading to shortened lifespans for the equipment. Some may even steal computer parts. ICT implementation must be supported by a well-coordinated and managed system that clearly defines responsibilities, such as who will assist teachers in classrooms, monitor ICT progress in schools, or conduct ICT training sessions [18].

Practical factors include management and coordination, availability of time for teachers and students, access to technology, adequate training, and school support. Attitude and ethical factors encompass each school member's perception and beliefs, as well as school characteristics [19].

Another critical aspect of organizational development is school policy supporting ICT use. According to the OECD, curriculum and organizational structure changes are necessary to support ICT effectively. The traditional curriculum cannot accommodate ICT, so fundamental curriculum changes are needed [20].

3. Digital Divide and Equality in Access to Education

The digital divide refers to the gap between those who have adequate access to information and communication technologies (ICT) and those who do not. This divide is particularly significant in the context of education, as access to digital resources has become increasingly vital for student learning, engagement, and overall academic success. Inequities in digital access can hinder the ability of certain students to participate fully in the educational process, thus perpetuating existing social and economic inequalities [21].

In educational settings, the digital divide can manifest in various ways. Differences in access to devices like computers, tablets, and smartphones, as well as disparities in high-speed internet availability, create unequal opportunities for students. Those in rural or under-resourced areas often face significant challenges compared to their urban or better-funded counterparts. Additionally, students from low-income families may lack the financial means to obtain the necessary technology or to maintain internet access at home, making it difficult for them to complete assignments, participate in online classes, or access supplementary learning materials. This unequal access to technology can result in lower educational attainment and a limited ability to develop essential digital skills, both of which are crucial in today's increasingly digital economy [22].

The digital divide also affects the quality of education students receive. While technology-enhanced learning environments can promote personalized learning, encourage student engagement, and facilitate access to a wealth of educational resources, these benefits are only available to students who have reliable access to digital tools. Students without such access may experience a lack of motivation and a sense of exclusion, as they are unable to participate in the same activities as their peers. Furthermore, teachers in under-resourced schools may lack the necessary support and training to incorporate ICT into their lessons effectively, which compounds the problem [23].

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Addressing the digital divide requires a multi-faceted approach. Governments and educational institutions need to invest in infrastructure that ensures all students have access to the necessary technology and internet connectivity. Programs to provide low-cost or free devices to students, particularly those from low-income families, can help bridge the gap. Additionally, public access points, such as libraries or community centers equipped with computers and internet access, can offer students a place to engage with digital learning resources outside of school hours [24].

In tandem with improving access, digital literacy programs for both students and educators are essential. These programs can empower students to utilize digital tools effectively and help educators integrate technology into their teaching practices in meaningful ways. Addressing the digital divide also requires collaboration between schools, families, and communities to create supportive environments that value and promote digital inclusion [25].

Ultimately, closing the digital divide is not merely about providing access to technology; it is about ensuring that every student has the opportunity to thrive in an increasingly digital world. By prioritizing digital equity, educational systems can help to break down barriers to learning, foster greater social and economic inclusion, and equip all students with the skills they need for success.

4. Learning Object Repositories

Learning Objects are digital resources with defined educational value that can be utilized in various ways to enhance teaching and learning. They enable the sharing of high-quality educational content aimed at specific and well-known educational goals, which can assist teachers across all levels of education in developing excellent teaching programs quickly. At the same time, students benefit from the ability to repeat activities as needed to fully grasp concepts [26].

Open Educational Resources (OER)

Open Educational Resources (OER) are teaching resources that either have an open intellectual property license or are part of the public domain, free from copyright restrictions. Depending on the licensing terms, these resources can be freely accessed, used, modified, and shared (Margaryan & Littlejohn, 2007). OER includes teaching, learning, and research materials that are either public domain or released under licenses that allow free use and repurposing. These can include full courses, course materials, modules, textbooks, streaming videos, tests, software, and other tools or techniques to support access to knowledge [27].

UNESCO defines OER as any educational material in the public domain or released under an open license, meaning anyone can legally copy, use, adapt, and share it freely. OER can include textbooks, curricula, lecture notes, assignments, tests, audio, video, and animations [28].

In recent years, OER has gained considerable attention, although an accredited resource framework for OER has not yet been established. At the UNESCO-IIEP Forum (2012), it was agreed that OER should encompass open course content, open-source development tools, open standards, and licensing tools [29].

One major driver for OER adoption, such as open textbooks, is that they are free. However, cost savings are not the only advantage of using them. They are integral to open pedagogy and can create a strong learning experience for students. Studies have shown a positive correlation between OER usage and students' academic achievements, suggesting they can help reduce withdrawal rates while improving overall grades [30].

Technologies that facilitate OER distribution include institutional repositories, specialized repositories, websites for specific content types (e.g., video, images, e-books), and global repositories. Content

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aggregation services also compile and describe content from various collections, which can be subject-, region-, or resource-type specific [31].

Blended Learning

Blended learning, which combines online digital media with traditional classroom methods, has become one of the most accepted learning approaches. It allows learners to experience both digital and face-to-face instruction. Using online learning methods in blended learning supports course designers in selecting preferred learning materials. OER is becoming increasingly popular among online course designers since it includes publicly available educational materials, which offer educators the flexibility to innovate in their teaching practices through open licensing. Utilizing and adapting OER has been proposed as a cost-effective investment in curriculum and quality teaching-learning material development [32].

5. Examples of Open Educational Resources

Project Gutenberg

Founded in 1971 by Michael Hart, Project Gutenberg now offers over 19,000 free eBooks, all in the public domain. Serving around 2 million eBooks monthly, it provides text-to-speech capabilities, human-read audiobooks, and digitized sheet music. As a volunteer-driven project, Project Gutenberg allows volunteers to register as proofreaders to correct scanned pages. When a volunteer chooses to proofread a page, the text and image files appear side by side, allowing easy comparison and correction. The edited text is then submitted back through the same web page for further verification. Once the initial proofreader's work is reviewed and any additional errors are corrected, the page moves through two formatting rounds to produce the final eBook. Volunteers are free to read as many pages as they like, with an informal goal of reading one page daily. The distributed proofreading system had over 3,000 active users as of September 2006, resulting in the creation of over 9,000 eBooks in six years [33].

ERIC (Education Resources Information Center)

ERIC provides free access to over 1.2 million bibliographic records of journal articles and other education-related materials, many with links to full texts. Funded by the U.S. Department of Education's Institute of Education Sciences (IES), ERIC is an online digital library for educational resources. It indexes more than 650 journals, with around 500 fully indexed, meaning that each article from every issue is included [34]. A smaller number of journals (about 150) are selectively indexed, focusing on articles directly related to education. Additionally, ERIC hosts over 100,000 full-text documents in PDF format, such as conference papers and reports, generally referred to as "gray literature" rather than traditional journal articles [35].

Open Access Journals

The number of open access journals has grown rapidly in recent years, with over 2,400 peer-reviewed, full-text scientific journals now available. An example is the Public Library of Science (PLoS), a non-profit organization of scientists and physicians dedicated to making scientific and medical literature publicly available. Founded in October 2000, PLoS journals are available online without access fees or redistribution restrictions, provided the authors and sources are cited under the Creative Commons Attribution license [36]. PLoS charges authors a publication fee that reflects the actual cost of publication, though there is a "no questions asked" fee waiver for authors who cannot afford it. PLoS now publishes seven open-access journals [37].

MIT OpenCourseWare (MIT OCW)

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MIT OCW is a large-scale, web-based publication of MIT's educational materials, providing open access to curricula, lecture notes, problem sets, exams, reading lists, and some video lectures. By May 2006, MIT OCW had published materials for 1,400 courses across 34 departments. MIT OCW is part of the OpenCourseWare Consortium, which consists of over 100 institutions working to create a broad body of open educational content using a shared model [38]. The consortium's mission is to advance education and empower people worldwide through open content. Participating institutions commit to publishing content from at least ten courses in formats that meet the agreed definition of open content. Other organizations that support the consortium's goals, such as translation and distribution partners, also participate in consortium activities [39].

6. Digital Educational Content in Greece

Over the past 20 years, Greece has undertaken significant initiatives to promote digital literacy in its educational system. These efforts have aimed to integrate Information and Communication Technologies (ICT) into schools, both as a way to enhance teaching and learning and to align with broader European digital education goals. As a result, a critical mass of educators now actively utilizes ICT in their classrooms, thanks to comprehensive programs that have facilitated this digital transformation. During this period, Greece has also developed a wide range of educational software products and learning resources, which have been made available to educators and students through national initiatives [40].

A central element of Greece's approach to digital education has been the prioritization of digital content as part of its National Digital Educational Policy, especially for primary and secondary education. This policy underscores the importance of ICT in enhancing the quality and accessibility of education [41]. To this end, Greece has implemented various projects to equip schools with the necessary digital infrastructure. Key components of this strategy include the development of in-service teacher training programs, which are essential for ensuring that educators can effectively incorporate digital resources into their teaching. Additionally, the policy focuses on establishing school-wide networks, computer labs, electronic classrooms, and interactive teaching systems that facilitate a modern learning environment [42].

The policy also emphasizes the creation and use of high-quality digital content. This involves not only developing new educational resources but also ensuring that they are accessible and reusable. To achieve this, Greece has established several digital repositories and platforms where teachers and students can find a wide variety of learning objects. These repositories, such as Photodentro, host a wealth of digital content tailored to the national curriculum and are designed to support interactive and personalized learning experiences. They allow teachers to find specific materials that meet their classroom needs and align with educational standards, fostering a cohesive approach to digital education [43].

Another essential aspect of the Greek digital educational strategy is fostering collaborative learning. By using ICT tools, Greek educators can promote student collaboration and active participation, both within and beyond the classroom. This aligns with the goal of creating a more dynamic and engaging educational experience that leverages the potential of digital resources to improve learning outcomes [45].

Overall, Greece's commitment to digital educational content reflects a broader strategic approach to integrating ICT in schools. By investing in infrastructure, professional development, and digital resources, Greece is creating a more inclusive and adaptable educational system. This not only enhances the learning experience for students but also prepares them for a digitally-driven future, consistent with the European Union's digital agenda [46].

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6. Digital Repositories in Greek Education

Aegean Observatory of the Refugee and Migration Crisis Repository

This repository collects and categorizes resources related to the refugee and migration crisis in the Aegean. It includes testimonies, unpublished and published records, statistical data, press releases, photos, and videos. It is supported by the National Documentation Centre, the University of the Aegean, and the Wenner-Gren Foundation for Anthropological Research [47].

Asclepius: Institutional Repository for Health Sciences

Focused on collecting, organizing, preserving, and showcasing scientific records related to health, this repository is open to scientific personnel and the public. It aggregates intellectual production from the Asclepius Voula Hospital [48].

Photodentro

Photodentro LOR is Greece's National Learning Object Repository for primary and secondary education, hosting over 4,000 learning objects with educational metadata, designed to be used autonomously. Developed by the Computer Technology Institute and Press "Diophantus," it supports browsing, free text, and multifaceted searches, allowing users to refine search results with multiple filters such as resource type and educational context [49].

Each initiative reflects the country's commitment to digital content development and the promotion of open access resources, aligning with the European Digital Agenda and the international movement towards freely accessible and reusable educational materials [50].

National Archive of PhD Theses

EADD includes doctoral dissertations from Greek universities and recognized theses by Greek PhD holders from foreign institutions. Supported by the National Documentation Centre (NDC), it contains over 25,000 doctoral theses [51].

National Hellenic Research Foundation Repository

The "Helios" repository organizes digital content across various scientific fields and provides tools for searching digital collections and services, accessible after registration, for researchers and the general public [52].

7.Conclusions

The integration of Information and Communication Technologies (ICT) in education has opened up vast possibilities for enhancing teaching and learning. By providing access to diverse resources, ICT enables more personalized and interactive learning experiences, supports students with special needs, and fosters engagement through collaborative and dynamic activities. The advent of Open Educational Resources (OER) further enriches this landscape, as these freely accessible materials allow educators to share and adapt high-quality content. OERs are instrumental in promoting equitable access to education, as they enable students from various backgrounds to access essential learning tools without the constraints of cost or availability.

Despite these benefits, implementing ICT in educational systems poses significant challenges. Effective use of ICT requires not only technical infrastructure but also a supportive organizational culture. For ICT to truly transform education, school leaders must actively endorse and facilitate its integration, guiding teachers and students through the adoption process. Leadership support is essential for fostering a culture that embraces digital tools and for ensuring that educators have the necessary skills to utilize

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these resources effectively. Furthermore, schools must align their curriculum and teaching practices with ICT to ensure that these tools enhance, rather than disrupt, the learning process.

Another critical issue is the digital divide, which can widen disparities in educational access. While ICT offers the promise of widespread access to information, students in under-resourced areas or from disadvantaged backgrounds may face significant obstacles, such as limited access to devices or reliable internet. This gap can hinder the equal distribution of educational benefits and exacerbate existing inequalities. Addressing these disparities requires targeted policies and initiatives, including investment in infrastructure and digital literacy programs for both students and educators.

The experience in Greece illustrates the importance of national strategies and the role of digital repositories in supporting ICT integration. Projects like Photodentro and Helios provide centralized platforms for accessing and sharing digital educational content, supporting the country's alignment with European goals for digital education. These repositories ensure that teachers and students have access to a curated collection of learning objects and resources, facilitating the broader adoption of digital practices within the classroom.

In conclusion, while ICT and OERs offer substantial potential for improving education, their successful integration requires a holistic approach. This includes investment in infrastructure, professional development for educators, and an emphasis on equity to bridge digital gaps. By addressing these areas, educational systems can maximize the benefits of ICT, creating more inclusive and effective learning environments for all students.

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