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Digital technologies in lifelong learning

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Abstract

This paper's goal is to review some sample articles that have been published between the years of 2003 and 2013 that deal with lifelong learning and ICT. With particular emphasis on third-age learners, the use of ICT in lifelong learning is examined in relation to various learning environments, including formal, informal, and non-formal learning. A special emphasis is also placed on the technologies and particular tools used to provide lifetime learning. Examined is the function of ICT networks, web technologies in e-learning, mobile learning tools, and virtual worlds as knowledge-sharing facilitators in various learning environments.

Keywords: e-Learning; ICT; Lifelong learning; Digital technologies

1. Introduction

According to Coffield, who made this claim in 1997, lifelong learning encompasses not only the academic requirements of the law, but also activities related to higher education, continuing education, and training throughout one's lifetime [33]. ICT is connected to lifelong learning in all learning environments. For each sort of learning environment, this relationship is looked into separately. Numerous research and opinion polls about the formal education system have been carried out by universities. To encourage a link between theory and practice, online learning communities have been developed. With the use of electronic portfolios, teachers may play a crucial role in helping students improve their lifelong competency in lifelong learning abilities. The need for skilled workers with new abilities to fill newly generated positions is growing, so vocational training has to receive extra focus. E-learning is beneficial for continuing education and aids workers in achieving the objective of lifetime learning, according to surveys and research done in small and medium-sized businesses. The crucial importance of public libraries in family learning is also demonstrated by projects supported by the EU. According to university interviews, academics place a high priority on using the Internet and attending conferences.

The relationship between third-age and lifetime learning is also looked at, as the latter should be encouraged for elderly individuals as well. Social networking is a great tool for senior folks to strengthen their ICT abilities, and ICT may be utilized to better prepare seniors for the demands of the computer.

In the fourth section of our review, we try to highlight the technical advancements that support lifetime learning. Several initiatives that consider ICT applications and their influence on the lives of lifelong learners have been completed during our research period. Due to its ability to address challenges such a shortage of resources and materials, e-learning has significantly improved educational issues. In this setting, communities of e-learning practitioners benefit from collaborative learning to facilitate lifelong learning. Collaboration in e-learning practice communities inside web-based professional networks is shown to facilitate active engagement in lifelong learning activities, according to research in the field of collaborative mentor assistance.

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This framework looks into how a learner's professional life may be impacted by their participation in online learning communities. Social virtual worlds may be utilized as a platform to assist lifelong learners in making career and educational decisions. The usage of Web 2.0 and 3.0 virtual technologies has shown that learning is participatory in a networked society. To link dispersed learners and facilitate easy access to lifelong learning resources, learning networks are built.

Finally, the emphasis in the most recent literature has switched to mobile learning, which offers access to ubiquitous computing. Passing from e-Learning to m-learning, mobile phones could promote lifelong learning and help lifelong learners create knowledge across their life.

2. Selective lifelong learning settings

2.1. Formal and non-formal Learning

2.1.1. *The function of educators and universities*

According to reference [1], which examined the usage of communication and information technology (C&IT) in universities, it is not as common as one might anticipate. The flexible availability of a variety of learning activities intended to promote lifetime learning is crucial, but so is ongoing professional development. Opportunities for open and distant learning built on C&IT seem crucial in obtaining this flexibility. Universities will need to modify their continuing education role in accordance with the most efficient ways that organizations can be networked to make the most of new technologies.

In the learning society, it is necessary to have lifelong learning abilities such the capacity to solve issues, work both independently and as part of a team, communicate effectively in all forms and at all levels, and self-direct one's learning and professional development goals. According to Massey University in New Zealand's reference [2], universities should be in charge of ensuring that their students are prepared for lifelong learning. With the support of qualified representatives, students might increase their proficiency in terms of lifetime learning abilities by creating electronic portfolios.

In order to better understand how professors feel about using the ICT resources offered on its virtual campus, the University of Las Palmas de Gran Canaria polled its faculty. According to the survey's findings, which were given by [3], participants were eager to integrate ICT into their everyday routines, supporting the university's efforts to include ICT tools wherever possible. The University responds to the difficulties of the brand-new shared European Space by integrating ICT technologies wherever it is practical. Learning is more widely available, everyone has equal access to school, and lifelong learning is supported.

2011 saw the completion of another study at an Australian institution. Undergraduate students majoring in scientific communication participated in this study, which was presented by [4]. The participants worked in smaller teams to build their subject-matter expertise by developing digital knowledge maps. The results show that the digital open-ended mapping enhanced pupils' capacity for lifetime learning. Although they efficiently utilised information and communication technologies and collaborated with others, students also gained more autonomy and ownership over their education.

The "Sportfolio.si" has been created at the University of Ljubljana's Faculty of Sport in order to facilitate communication between sport students, academics, and in-school mentors. In the sphere of practical pedagogical training, Reference [5] created the first online community in Slovenia that allowed students, assistant teachers, and instructors "in practice" to share ideas and experiences, fostering a connection between theory and practice. The results show that this method increases the community of teachers-mentors and students in practical pedagogical training and offers support for lifelong learning, encouraging the development of competencies for a society of knowledge with the use of ICT.

The knowledge-based economy requires continuous competency improvement. ICT can improve the teacher training process, and this can be leveraged to support teachers' lifelong competency development. [6] outlined how using a software platform for lifetime competence development might enhance teachers' in-service training within the context of the EU-funded TEN Competence project. Teachers learn how to impart ICT-enhanced skills that are considered fundamental for every job and citizen.

Regarding the pedagogical integration of ICT, [7] discussed how crucial ICT is to bringing about improvements in classroom instruction. The pedagogical attitude of the instructor was taken into consideration when designing the

Second International Information Technology in Education Study 2006 (SITES 2006). According to earlier research (SITES M1 and M2), classrooms that have embraced the promise of ICT to foster the development of students' 21st century skills tended to be more socially connected. In addition to being traditionally significant, 21st century oriented pedagogical orientation can be further broken down into lifelong learning and connection focused.

2.1.2. The role of enterprises

The requirement for qualified workers who will benefit from lifelong learning outside of traditional educational institutions was underlined in ref. [12]. Being a highly skilled worker in the European information society means having the new skills necessary for the new employment. The working population will therefore need to be trained in order to meet the demands of the labor market. Companies and systems for education and training should consider how to seize the chance that ICT-enabled communities can present. Online communities could fill the need for acquiring new skills for career changes in this context.

In reference [13], it was examined whether e-learning could be developed as an alternate method of providing public health nurses with ongoing education. In a study conducted in Taiwan with 233 randomly chosen public health nurses, data were gathered through mailing methods and a structured questionnaire. The authors reaffirmed the suitability of asynchronous e-learning programs as a means of continuing education for public health nurses. All health care professionals could utilize e-learning as a useful learning strategy to assist them meet the objective of lifelong learning.

The lifetime learning, continuing vocational education, and distant learning educational fields have all been impacted by the ICTs' quick development. Modern web-based technologies and broadband networks also ushered in e-learning and Open and Distance Learning (ODL), taking into account that the majority of teaching is done remotely in terms of both place and time. According to this definition, [14] proposed the concept of a virtual class for the field of electrical engineering, highlighting the demand for the creation of training programs tailored to corporate requirements. And considering that people must continue their education and training at various points during their working lives in order to preserve their employability, one could argue that lifelong learning is now a reality.

For small and medium-sized businesses that must contend with monetary, psychological, and technological constraints, advancements in ICTs and the growth of electronic learning may prove to be quite alluring. In order to better understand how employees and employers feel about e-learning, Reference [15] performed study in North Wales, which is a remote and rural area. The results show that employers' attitudes and a lack of understanding of computer systems are two challenges that face electronic learning. Employers and employees must adopt a favorable attitude toward e-learning in order to promote participation in ongoing learning as a way to improve employee and owner/manager skill sets and give access to new learning and development possibilities. The UK government launched an initiative to create a national infrastructure for lifelong learning by opening learndirect centers in local communities where current and potential employees can access personal and work-related learning. The University for Industry, which was renamed "learndirect," served as the umbrella organization.

A specialization of the IEEE Learning Object Metadata (LOM) standard was introduced in Reference [16]. Within the framework of the Rural e-Government initiative, this standard is used to facilitate the description and classification of learning resources for rural small and medium-sized businesses (SMEs) in five European areas. For a digital learning repository (DLR) intended to support the vocational training of SMEs in rural areas, the design of a suitable metadata schema is investigated. The findings suggest that agricultural professionals' requirements for lifetime learning could be covered with the aid of ICT, supporting by extension rural development.

2.2. Informal Learning

It is noteworthy that ICT also supports and facilitates adult informal learning. Informal learning is thought to be just as significant as formal learning contexts and encompasses many facets of life, including hobbies, employment, and daily activities. Reference [8] looked on how adults utilize ICTs for informal learning. According to their survey, this field of ICT-based learning may help realize ICT's promise to remove institutional barriers to learning and enable users to encourage independent study. We need to improve our understanding of ICT and informal learning since motivated informal learners appear to be more drawn to ICTs than motivated formal learners.

The UK government and non-governmental organizations have acknowledged the value of family learning within the broader context of lifelong learning. Family learning must be coupled with informal learning, according to reference [9]. Family learning services can be developed and provided in large part by public libraries. With increased awareness of their significance in modern culture and as the primary providers of information and communication technologies (ICT)

in the community, libraries can be considered as the ideal location for family ICT. Family learning may have a significant impact on the subject of lifelong learning because it has been significantly linked to social inclusion.

According to reference [10], public libraries are switching from a passive to an active method of information distribution. In an effort to improve adults' information literacy through informal learning, the PULLS (Public Libraries in the Learning Society) initiative, which was supported by the EU's Socrates program, promoted the idea of the public library as an open learning center. Libraries have discovered a method to rekindle interest in them and play a crucial role in the 21st century by providing ICT access and support. Libraries do have an important role to play in promoting the development of both ICT skills and broader information literacy.

According to Ref. [11], lifelong learning should include all forms of official, non-formal, and informal education, from early childhood through post-retirement. The results of 36 interviews with fully qualified and tenured academics chosen from information systems programs at sixteen universities revealed that informal learning is highly valued. Academics studying information systems place a high value on structured methods of informal learning that allow them to engage with other academics. When developing their policy decisions, university administrators should keep in mind that their academics place a high importance on attending conferences and using the Internet.

3. Benefits of lifelong learning to the third age

The use of new technology in a society built on knowledge necessitates the presence of abilities that may exclude members of particular social classes, primarily the elderly. Programs for lifelong learning should be created to give seniors options. The development of ICT skills has become essential if they are to continue being active participants and not be excluded from social, cultural, and economic life. Reference [17] described the methodology and outcomes of a social networking-based targeted learning course that allows for the development of ICT skills. Ref. [18] presented the results of a focus group within the Memory Line Project in Italy. In order to assure their preservation in the field of lifelong learning, the Grundtvig Socrates "Memory Line Project" trains senior and young residents to gather records and conserve them in digital form. It is encouraged to use a memory- and communication-based interregional and intergenerational learning approach. Overall, the project encouraged seniors to change their negative perceptions of computers and collaborate with Net Generations by opening a channel of communication based on mutual respect.

4. Lifelong learning and digital technology

In reference [24], eLearning was portrayed as the solution to all of the developing world's educational woes. ICTs are opening up new options for underdeveloped nations by addressing a variety of educational problems such a lack of resources and study materials. Virtual learning environments (VLEs) can enhance or support learning and teaching in the context of eLearning because education is thought to be the sector that uses computer software the most. The introduction of online 2.0 has the potential to assist lifelong learning and can further improve the usage of online technology in eLearning.

4.1. Virtual world and Web 2.0 technologies

A framework for creating a distributed network to enable lifelong learning in ICT networks was provided in reference [19]. Because they may be used to connect dispersed students and providers in a field to create Learning Networks (LNs), ICT networks hold great promise for lifelong learning. The self-organization theory-based design model created by the authors makes use of open learning technology standards and software agents, the majority of which were created by IMS (imglobal.org), IEEE (ltsc.ieee.org), and AICC (aicc.org). The Groove (Groove.net) platform was chosen in order to meet the specified requirements because it could be easily adjusted. The authors contend that despite the limitations of the paradigm, ICT networks can allow ubiquitous, seamless access to lifelong learning facilities at home, at work, in school and universities.

Communities of practice (COPs) in an institutional setting that promotes lifelong learning should be guided by principles, structures, and tactics tailored to practitioners using democratic collaborative learning methods. The Joint Information Systems Committee (JISC) infoNet Collaborative Approaches to the Management of E-Learning (CAMEL) and e-learning Independent Study Award (eLISA) initiatives were described in reference [20]. Two new theoretical collaborative team leadership and operational models are offered to encourage lifelong learning on the basis of the methods used in these two online learning projects. There is a claim that a distributed-coordinated collaborative team leadership model is more successful and that e-learning teams thrive in deliberate communities of e-learning practice where there is a climate of trust and respect.

In order to address the needs for continued professional development (CPD) in the Irish construction industry, Ref. [21] presented the MERIT simulation game as part of a blended learning program. With the goal of assisting participants in developing their analytical skills and problem-solving methods in a construction organization, collaborative learning would be encouraged through the simulation game. If the management of the integration of the simulation games is carried out in a thoughtful and planned manner, it can give a highly effective improvement to the learning experience for professionals who seek to engage in possibilities for continuous professional development.

Membership in virtual learning communities (VLCs) can encourage lifelong learning, according to reference [23]. Members of the VLC have the opportunity to significantly alter their lives as well as their learning careers. Communities must offer a safe and encouraging online environment in order to successfully encourage individual transformation. The comfort zone within the community allows its members the chance to develop their confidence outside of the safe confines of the community.

Reference [25] described the Lifelong Learning Programme-funded cooperative initiative called "NOVICE" that five European veterinary schools worked on together. In terms of the usage of Web 2.0 capabilities (such as forums, instant messaging, voice calls and video conferencing, social networks, etc.), this partnership aimed to create a web-based professional network for the veterinary profession. According to the study's findings, the veterinary industry will probably start using more Web 2.0 technologies for lifelong learning. Participation in online communities fosters unintended informal learning that would not otherwise be accessible, offering a number of benefits over face-to-face communities.

ICTs have been regarded as enablers that can support learning whenever and wherever it takes place, with lifelong learning including all learning activities throughout life. Reference [26] encouraged the use of social media for professional development. Due to the fact that the majority of empirical study on the use of social networking sites has been done in the educational sector, using Facebook for professional purposes is a new phenomenon. The authors, who view Facebook groups as networks of practice (NoPs), concentrate on the creators and members of five Italian Facebook groups in order to examine the nature of discussion topics, group membership, participation levels over time, and the interaction of online and offline activities. Their findings suggest that the different thematic characterization of the groups has an impact on their membership in terms of the type of social capital and that group typology is correlated with the impact on real life of members in professional terms.

The significance of Web 2.0 and 3.0 virtual tools for lifelong learning was mentioned in reference [27]. In today's digital and linked environment, learning now happens through interaction rather than on an individual basis. E-skills are becoming more and more in demand in the networked society. ICT practitioner skills, ICT user skills, and ICT business skills are three key categories of e-skills that have been recognized. The soft skills that can be developed in social, collaborative, and virtual environments must coexist with e-skills and e-literacy. With the help of the interactive 3D virtual worlds and the collaborative web, students develop new learning profiles and improve their readiness for lifetime learning. Those who are not as computer savvy must adjust to this profile.

Reference [28] focuses on the potential use of virtual worlds for training and education. The authors investigated the efficacy of the four dimensional framework (learner, pedagogic models, representation, and context) in order to assess the effectiveness of using Second Life (SL), a social virtual world, as a platform for assisting lifelong learners. This study was designed with two defined groups to evaluate the potential of using a virtual world to support lifelong learners in their career and educational decisions. Because of the technological difficulties users encountered on the testing day, open source developers created OpenSim, which enabled the application to be hosted behind institutional firewalls. Although findings did not prove that SL could help learners with career decisions and educational choices, they indicated the power of the tool for supporting distributed learning communities based upon shared interests.

5. From online education to mobile learning

A suggested e-book interface in reference [22] allows students to ask questions in a classroom setting. After reviewing the questioner's biography and grading the question's difficulty using a rating system, the question is then posted in a discussion forum and a mentor is chosen to respond. Students can access the mobile discussion forum by voice or text using their mobile phones without regard to location or time. The study's findings show that despite usability issues, the majority of learners really benefited from collaborative mentor support, which promoted self-directed learning and knowledge sharing for lifetime learning.

Education is no longer a privilege reserved for the wealthy. Anyone can now access it. Virtual classes and distance learning have been introduced to traditional classroom instruction. According to reference [29], using technology can

offer a flexible learning framework that adult learners desire. These people have access to technology that allows them to learn anywhere, at any time, opening up new options for educators. It is understood that formal material can be learned in informal settings since most learning occurs outside of the classroom. The successful creation of a mobile framework for lifelong learning, according to the authors' study, depends on creating a theory for mobile learning.

In the conceptual framework of ubiquitous knowledge building, reference [30] redefined mobile learning. The authors offered an alternate definition of mobile learning that places an emphasis on "widespread," "just-in-time," and "when-needed" computing capacity for learners as they transition from e-learning to m-learning. Mobile learners use ubiquitous computing technologies, which are a part of mobile hardware, mobile software, and mobile interface, in the m-learning infrastructure. Their work connects mobile learning, constructivism, and lifelong learning while examining pedagogies for mobile learning. The breadth of ubiquity is increased throughout the person's lifespan by using constructivism as the theoretical foundation for efforts to address the difficulties of LLL.

The Commonwealth for Learning (COL) has created a framework for Lifelong Learning (L3) for Farmers, based on the idea that open and distance learning (ODL) and ICT may help the underprivileged groups in rural communities to learn on their own initiative. The use of mobile phones as a learning tool by rural women in Southern India was researched in ref. [31]. This joint project with a non-governmental organization called "Vidyal" was founded on the idea that if the women created business plans to secure loans to launch small businesses, not only would they be able to repay the loans, but the banking industry would be persuaded to support L3 as a business strategy. Mobile phones were introduced in this study as both educational and professional tools. The control of technology in the context of social capital, with components of appropriation, objectification, incorporation, and conversion, showed that the shift from relying on outside authorities for knowledge to producing knowledge is achievable in non-formal learning environments. In terms of gender, women in both developing and developed nations can be encouraged to pursue lifelong learning through the use of technology.

Finally, it is important to highlight the productive and effective role that digital technologies play in the Long Life Learning sector. These technologies, such as mobile devices (36-37), a variety of ICT applications (38-52), AI & STEM ROBOTICS (53-54), and games (55-56), facilitate and enhance learning procedures such as assessment, intervention, and learning. Additionally, the use of ICTs in conjunction with theories and models of metacognition, mindfulness, meditation, and the cultivation of emotional intelligence [57-74], accelerates and improves educational practices and outcomes, particularly in LLL sector and its applications.

6. Conclusion

In our review study, we made an effort to describe ICT developments in the area of lifelong learning, taking into account all possible learning contexts. Universities should be considered in both formal and informal contexts for their critical role in bridging theory and practice. Teachers and mentors should assist students in increasing their competency in terms of lifetime learning skills. With the aid of ICT, vocational training should be connected to business requirements in order to support people in maintaining their employability. Informal learning, which offers chances for interaction with other academics, is also demonstrated to be highly valued by academics. With the use of ICT, family learning and public libraries can assist remove institutional barriers to learning and draw in informal learners. As a final point, senior folks should be included in lifelong learning initiatives to benefit from technological advancements and promote social inclusion.

Throughout the ten years of our research, we attempted to compile all the technology related to lifetime learning. In communities of e-learning practice, collaboration has evolved as a crucial component of information sharing and self-directed learning. E-learning can assist in removing obstacles to education and offers emerging nations new options. Lifelong learners can communicate socially and professionally thanks to Web 2.0 and 3.0 virtual tools. The challenges of omnipresent knowledge production in the current lifelong learning framework can be met by mobile learning since these tools can be made available to learners whenever and wherever they need them. Learning can now be done everywhere and at any time thanks to ICT. How well policymakers will advocate for this technology-based lifelong learning to all members of society remains to be seen.

Compliance with ethical standards

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The Authors proclaim no conflict of interest.

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