Available online at www.qu.edu.iq/journalcm
JOURNAL OF AL-QADISIYAH FOR COMPUTER SCIENCE AND MATHEMATICS
ISSN:2521-3504(online) ISSN:2074-0204(print)

Enhancing Technical Skills Through Hypermedia: An Exploration of Innovative Learning Approach

Sawsan Mousa[a], Mustafa Radif[b]

[a]University of Al-Qadisiyah – College of education .Email: sawsanalhassani66@gmail.com

[b]University of Al-Qadisiyah – College of Computer Science and Information Technology. Email: mustafa.radif@qu.edu.iq

ARTICLEINFO

Article history:
Received: 30/07//2024
Revised form: 15 /09/2024
Accepted :19 /9/2024
Available online: 30 /09/2024

Keywords: Hypermedia, Educational Technology, Multimedia Learning, Interactive Learning, Curriculum Design, Distance Learning, E-learning Platforms, Digital Education, Learning Retention, Learning Environment Design.

ABSTRACT

The integration of hypermedia in educational contexts has the potential to significantly enhance the development of technical skills, a critical competency in today's technology-driven world. This paper explores innovative learning approaches facilitated by hypermedia, focusing on its application in technical education. The study begins with a discussion on the general importance of technical skills, followed by a detailed examination of hypermedia as a dynamic and interactive learning tool. Two case studies are presented, demonstrating the successful implementation of hypermedia in educational settings, and the challenges and benefits associated with these approaches are analyzed. The paper concludes with insights into future research directions and emerging trends in hypermedia-enhanced technical education, emphasizing the need for continuous innovation and adaptation in the face of evolving educational technologies.

MSC.

https://doi.org/10.29304/jqcsm.2024.16.31878

1.Introduction

New information and communications technology (ICT) have made an enormous impact on business, the environment, society, the economy and learning. As Kolb points out, knowledge gets created through the transformation of experience. It might be the case that some new technology will replace or radically change some existing processes. On the other hand, some technology has the prospect to more or less stay. ICT is the foremost investment opportunity in the 1990s and, as with most of the technologies, there is a clear limit to the lifetime or the payback time of that technology in its original form. Therefore, general rationales for using new technology in learning are important at this specific point in time. Literature provides such a rational basis for learning with hypermedia [1]. This exploratory essay elaborates such a discussion further in connection with existing relevant learning theory literature and examines some innovative learning environments through hypermedia.

The focus of this exploratory essay will be on enhancing technical skills through the learning of hypermedia. The first part discusses technical skills on a general level. The second part presents two complete implementations of learning environments through hypermedia and discusses their closeness to the designed learning environment. The third

∗Corresponding author Mustafa Radif

Email addresses: mustafa.radif@qu.edu.iq

Communicated by 'sub etitor'

part raises some points for future research. Finally, an analysis of learning skills and of the development of hypermedia-supported environments for learning technical skills will be presented [2].

2. Understanding Hypermedia in Education

There is almost no chance to enter in the job market or develop one's career without a thorough knowledge of technical skills. The domain of some of those technical skills is however often considered to be purely dumb, i.e. akin to riding a bicycle or mastering similar crafts that once learned will be unforgettable for living. The present work shows how hypermedia may be manipulated in order to enhance professional development of technical knowledge on a complex subject where a non-dumb learning has been proved to be very difficult. From the results reported, it is hoped that researchers on hypermedia, and more generally on educational technologies on other fields, will be able to gather some motivation, rewards and satisfaction for their efforts. Educators and trainers who share the belief that relearning a civil engineer's craddle is a myth of children should also find here some practical ideas to overcome this problem. Close friends, family and generous fellows might appreciate this work for being nevertheless an easy reading [3].

The term hypermedia is widely used today, and it would almost seem to be too simplistic, for better or for worse. Hypermedia is much more than the mere definition of a hypertext multimedia system, even if the word is often misunderstood and improperly branded. Hypermedia is technical and information technology related but it is also part of a global social context and, within the context of education and of educational technologies, hypermedia is both a boon and a ban [4]. The primary aim, distilled from the extensive literature research, is to introduce the concept of hypermedia and the role played by the hypermedia paradigm on the learning process in such a way that this stimulating yet feared word be no longer unknown by the attending audience on that presentation, nor misunderstood, wrongly employed or avoided thereafter on the succeeding stages of their teaching and research activities [1].

2.1. Definition and Characteristics

Hypermedia is a term used to describe computer systems that let users link multimedia data like text, sounds, and images through related information [5]. This term goes beyond the definition of hypertext, which only covers text. As a part of modern educational technology, the proliferation of multimedia data has led to the incorporation of hypermedia (pop-up windows, sound effects, and movie clips) into the modern classroom. Educational hypermedia systems now include general-purpose and subject-specific systems that allow students to view and manipulate text, images, and sounds. Teachers can prepare hypermedia lessons and organize the material provided by these lessons. Hypermedia links can only be activated in a specific manner or in a particular order, meaning the teacher has some control over their use in lessons [3].

Four basic characteristics of hypermedia come into play regarding computer systems. First, hypermedia is an integrated computer system that combines the basic elements of hypertext (text information) multimedia (non-text information), and database management [6]. As computer hardware systems become more powerful, the multimedia component of hypermedia is enhanced. The multimedia component comprises mixed forms of data, such as text, numbers, speech, drawings, pictures, images, audio, and video. In hypermedia, the user is provided with multimedia data that is accessible and movable in a nonlinear manner. With hypermedia technology, whenever a user receives visual and audio data from more than one source simultaneously, he/she is in a hypermedia environment. Hypermedia does not exclude a specific type of media; therefore, it may be regarded as digitalized paper. It is widely accepted that words or texts alone cannot formulate an idea without visual aids [7].

2.2. Benefits and Challenges

Integration of hypermedia in education is a powerful and innovative learning approach that can potentially enhance the technical skills of learners; however, incorporating hypermedia in education has its challenges as well. As hypermedia consists of various elements such as audio, graphics, text and images, any of these hypermedia elements used can improve learning, retention and replicability of information [8]. It permits learners to select what, when, at what pace and in what order to learn their program, rendering learning more enjoyable and effective. It is thought to develop higher-order thinking skills, as learners hypothesize and explore their environment. Another potential benefit is proficiency in the use of computers and other technology-based media, with accompanying 'transferable skills' sought by employers and organizations outside the education sector [9,10].

But with the benefits offered by hypermedia in education and bringing forth innovative learning, there are challenges encountered by educators and learners as well. Over the years, experts in the fields of mandated education, pedagogy and curricular model development have put forth a plethora of external and internal challenges in the use of technology-based education to the unique culture of specific group of countries, states and institutions [7].

3. Innovative Learning Approaches

This project focuses on the authoring of educational hypermedia. In operation as an authoring tool, HyperMap enables teachers to create a hypermedia presentation and hypermedia navigation to it as a basis for learning with hypermedia. In educational applications it has been found that, in traditional textbook form, the design of curriculum is rather exotic. The different design choices in the curriculum are invisible for a learner, while it is these design choices that influence the effectiveness of learning [1]. It is believed that a lot of the extra potential of hypermedia for education cannot be reached without investing in the design side of hypermedia use in education. This possibility to design the hypermedia space and hypermedia navigation to it and to generate an ideal textbook representation for the target population is the focus of this project. The main objectives of this project are to:

1. enhance the general knowledge of teachers with respect to educational hypermedia, thus creating a basis for better use of existing off-line and on-line educational hypermedia.

2. gain insights into the possibilities of spatial hypermedia for educational purposes by constructing and evaluating a number of HyperMap applications.

3. create the HyperMap tool for designing and generating text, (interactive) graphics, audio, video, etc. based presentations of educational content and routing curriculum through it.

Moreover, this research includes building and bringing into practical operation a HyperMap design tool and designing and generating a hypermedia representation of the chain reaction in which both text and visuals complement each other in order to reach a more informative representation for learners [11].

3.1. Hypermedia Integration in Curriculum Design

The effective inclusion of assorted hypermedia tools and hypermedia-related resources has surfaced as one of the focusing issues for the academic curricula design [12,13]. The Curriculum Design and Development Group associated with the Human Development and Capacity Building Program at the National Institute of Technical Teachers Training and Research (NITTTR) has investigated the routes to promote the development of technical skills of the learners through hypermedia. Some educational environments have been developed in recent years incorporating hypermedia in assorted disciplines including the sciences (e.g. geology, biology, cosmology, astronomy, material science, and chemistry), engineering (mechanical and electrical), and text processing. The hypermedia environments are explored within a control and guidance framework for learning with set hypermedia [1].

An educational hypermedia environment generally encompasses a hypermedia database, an authoring tool, and an interface development tool. The multimedia database Haravi has over 9000 items (pictures, texts, maps, and film) on aerosol research. The database has been educationally enriched with 274 hypertext descriptions. The generic hypermedia access tool has a browser option as a structural hypermedia view of the whole database equipped with an atmosphere/aerosol model (addition to text). The user study indicates a preference for guided navigation. Two domain-oriented changes are discussed. The hypertheme prototype is a pedagogic hypermedia able to process a variety of external and internal control and guidance strategies. Hypermedia will be recognized as a promising multimedia system if a generic controlling architecture operates across domains with different design solutions.

Reasons for the Development and Promotion of Hypermedia-Based Courses in Technical Education: The hypermedia environment used to research the development of skills in reading and comprehension of technical English texts with a discipline-related content [14,15]. The discipline is computer-aided design systems for mechanical devices covered in the sixth semester. A course in technical English would be an appropriate supplementary course if the content of the English materials and the English language environment is related to the domain presented in the investigation. Hypermedia-based courses would promote the development of multi-skills required by the technical subjects. Hypermedia would provide non-linear links, variety in learning styles, remedial options, motivation through exploration, privacy in practice, and flexible control [7].

Education in the digital era must embrace technologies, including the use of hypermedia as a teaching aid that fulfills students' needs. Higher education institutions, including universities and colleges, have integrated hypermedia technologies in the teaching and learning process [16,17]. This study aims to identify the use of hypermedia technologies in higher education institutions during the COVID-19 pandemic. The respondents were EFL teachers and students at several higher education institutions in Nonthaburi, Thailand. A survey questionnaire consisting of closed-ended questions was administered to the respondents and analyzed using descriptive statistics. The findings revealed that during the COVID-19 pandemic, first, the learning challenges encountered by teachers and students were in the form of technical problems, such as Internet connection and access to technology, and external problems, such as student's focus in learning and lecturer's teaching styles. Mitigations of the challenges comprised informing students about the learning logistics, and using technology, such as recording meetings for students who were unable to join, and adjusting assessment models [18,19].

3.2. Interactive Learning Platforms

Innovative education can happen in a number of different ways. Higher learning is ever developing and changing; new technologies are continuously being introduced that enable learning to be carried out in ways that were impossible just a few short years ago. This enables more students to become educated, as options for attending classes become more diverse. Hypermedia is one such new technology that offers opportunities for learning that could otherwise escape participation by students. Hypermedia offered by the internet has the potential to completely revolutionize the way education occurs, and to also afford educators new opportunities to enhance the learning experience. Hypermedia can create a window to a larger domain of knowledge and information that is not restricted by traditional media from being transmitted to learners. With hypermedia the role of the learner can change to become active participants in their own learning via interaction and control of the learning process [20].

Currently much of the education that occurs, especially in technical and scientific areas, is concerned with the acquisition of technical skills. By using hypermedia learning can take place in a hands-on mode, where the learner becomes directly involved with the material to be learned, which has been shown to be a very powerful way to learn and reinforce knowledge. Hands-on experience has been identified as an important prerequisite for, and is regarded as absolutely crucial in the acquisition and enhancement of technical skills. The success of this mode of learning is largely dependent on how strongly the learner is actively engaged and participating in the learning task [21].

4. Case Studies and Best Practices

This section focuses on case studies and best practices that illustrate the successful implementation of hypermedia as an innovative learning approach in technical education. These real-world examples demonstrate how hypermedia systems have been designed and integrated into the curriculum, the experiences of educators and institutions, the outcomes achieved, and the valuable lessons learned.

One notable case study from Argentinean universities highlights the integration of a hypermedia education material (HEM) into a Computer Science students' course. The HEM was designed to provide a hypermedia language of mathematical objects and operations compatible with VHDL. Its educational material included an introductory text to the language, basic definitions, a glossary, a bibliography, and further educational material in other programming languages. The research aimed to collect qualitative and quantitative information regarding the influence of the HEM on the Teaching-Learning process of the course topics, such as the perception of mathematical knowledge, fluency in VHDL programming, motivation, and interest. Results revealed that the HEM was mainly used as an aide-model complementary to expositive classes. It encouraged greater programming fluency in students and fostered an interest in continuing the study of mathematics applications in computer engineering and the use of math-embedded languages. However, the perception of knowledge was regarded as more informal and less consolidated, and the use of the object-oriented programming paradigm was difficult for students without prior assembly language programming [8].

Another case study, conducted during the COVID-19 pandemic, describes the experiences of three higher education institutions in Ukraine that redesigned educational processes using hypermedia technologies. A survey questionnaire-based research was carried out among first-year students to investigate satisfaction with the changed educational forms. Results showed that despite organizational difficulties, most respondents considered the transition to distance learning positive. Hypermedia technologies were considered the most effective means for both ensuring the educational process and monitoring/controlling knowledge. The ability to access materials in distance mode and the use of many educational virtual platforms with varied educational resources were also highlighted.

Recommendations for further improvement in the use of hypermedia education technologies were defined, including dynamic design of distance course education support, professional ongoing development of academic staff, and ongoing monitoring and assessing the impact of hypermedia technologies on the educational process [7].

4.1. Successful Implementations in Technical Education

A series of successful hypermedia implementations is presented for various technical skills. These examples illustrate the positive impact of hypermedia on the enhancement of technical skills. An overview of standard projector-based hypermedia implementations is provided in the case of industrial electronics technology and air conditioning technology. These examples show how existing training manuals across many technical education programs can be easily adapted for learning with hypermedia. The impact on students' learning is documented in a controlled comparative study between standard training and hypermedia training [22]. Two advanced, full-immersion hypermedia implementations are described in the horticultural technology research project. These hypermedia systems offer unmatched freedom of navigation, remote control over real processes, and active participation in process management. Indications of significant learning outcomes related to advanced hypermedia presentations are provided.

When technologists attempt to model, control, and automate industrial processes, they always start with a study of process technology and the application of measurement and control technology to it. However, industrial process technology encompasses a relatively complex assortment of mechanical, chemical, pneumatic, hydraulic, thermal, and so on, techniques. As a consequence of the widespread introduction of concepts such as factory automation and total quality management, there is a rapidly growing need for training an increasing number of semi- and skilled personnel in the functioning of (industrial) processes and in the application of measurement and control technology to it. Because traditionally training has media as the basis of instruction, there is a long tradition of the use of textbooks, filmstrips, movies, chalkboards, and so on. However, present texts and static images never explain the functional nature of dynamic processes and systems satisfactorily [7].

4.2. Lessons Learned and Recommendations

Reflecting on the experiences with the three case studies, several lessons can be learned. There are many ways to use hypermedia as a learning innovation in a technical area. Hypermedia lab investigators in that area of education will probably find it helpful to examine the case studies as sources of inspiration. The experiences outlined in the case studies might also be valuable for those who are contemplating hypermedia learning innovation. For institutions involved in this kind of innovation, it is advisable to take various organizational aspects into account such as management of expectations, time-planning and decision-making procedures (Olena et al.2021)[23].

It is also important to foster discussion between involved actors, especially in the early stages of project. All three institutions successfully engaged in some kind of discussion forum to minimize communication problems between programmers and teachers. Consequently, it is essential to reach (temporary) agreements on the roles of the various actors involved. If this is not done, a power struggle concerning definitions of learning problems and learning solutions might occur [24]. It is also important to understand that institutions involved in learning innovations become platforms for individual change processes. Potential protagonists of innovation approach projects for a variety of reasons, such as personal ambitions, but also career considerations. Although these reasons for innovation are often not communicated explicitly, they should be recognized and taken into account. Fostering pro-innovation networks might help understanding what is learned from innovation processes and consequently assist institutions in institutionalizing learning innovations. As a consequence, editors and producers of hypermedia learning environments in technical areas become part of the technical subculture. They are likely to develop their own - partly intuitive - norms and standards, causing misunderstanding and frustration when interacting with educational subcultures [7]. Taking subcultures into account offers opportunities to clarify, negotiate and design new hybrid cultures, which might avoid power struggles and frustrating misunderstandings. Finally, it is vital to recognize that developers of hypermedia learning environments in technical areas need a great degree of professional autonomy. If programmers and teachers feel that they are being controlled, they are likely to lose interest in the innovation process.

5. Future Directions and Emerging Trends

The innovative learning approach through hypermedia for enhancing technical skills is considered in the context of its future directions and emerging trends. This consideration includes possible developing opportunities as well as

threats facing it later on. The future consideration is set against the backdrop of a fast-evolving educational technology landscape [2]. One obvious future direction for the proposed learning approach is in the realm of WWW-based distance (non-classroom) education. There exists a great opportunity to develop the proposed approach into a WWW-supported learning tool for helping students enrich their understanding of a technical discipline. Globally, many higher-education institutions are attempting to introduce fully on-line distance education programs and WWW has become a cost-effective delivery medium. Besides from the Web-based support, the proposal also plans to broaden its applicability in terms of technical fields and student population. Efforts will be made to make the tool applicable to a wider range of technical topics. At the same time, in addition to a fixed network deployment, a mobile version, with easily updatable contents, will be developed using handheld devices (tablet PCs, cell phones, etc.) so that the query answer sessions can be extended to labs and bigger venues like auditoriums [25,26].

As with any new innovative educational model, there are many uncertainties ahead. Those uncertainties span pedagogically, technologically and administratively. First of all, the long-term sustainability of the proposed approach depends upon its functionality and accessibility. Technology-wise, as having predicted, hypermedia will surely play an overwhelming role in educational technology in the next few years. What is more difficult to foresee is how well the current Internet-based bandwidth and interface technologies can keep up with those advances of hypermedia packages. Any time-consuming lags on technology deployment or product standardization in the future may cause unforeseen difficulties to either adapt to or enjoy the enhanced hypermedia. Pedagogically wise, as having predicted, educating a technical audience with non-classroom instructional models is still considered a high-risk high-return business initially. Schedules of on-going programs will be adjusted wisely according to the developments of the projects. Depending on the outcomes, the maturity of the innovating learning approach through hypermedia will be graded and competitive expansion will be implemented accordingly [27,28].

6. Conclusion

In conclusion, this study highlights the transformative potential of hypermedia as a tool for enhancing technical skills in educational environments. The integration of hypermedia offers a more interactive and engaging learning experience, which is crucial for the effective acquisition of technical competencies. While the benefits are significant, including improved learner retention and the development of higher-order thinking skills, challenges such as technological accessibility and the need for adequate instructional design must be addressed. Future research should focus on optimizing hypermedia tools to cater to a broader range of technical disciplines and educational settings, ensuring that this innovative approach continues to evolve alongside technological advancements. The ongoing adaptation and refinement of hypermedia-based learning environments will be essential to meet the demands of both educators and learners in a rapidly changing digital landscape.

Acknowledgements

We would like to express our gratitude to all the individuals and institutions who supported and contributed to this research. Special thanks to the College of Computer Science and Information Technology at the University of Al-Qadisiyah for their invaluable assistance and resources that made this study possible.

References

[1] A. Verhoeven and K. Warendorf, “External Navigation Control and Guidance for Learning with Spatial Hypermedia,” Journal of Interactive Media in Education, vol. 1999, no. 2, 1999.
[2] S. Quinton, “A brief critique on the future of learning: Assessing the potential for research,” in Contemporary approaches to research on learning environments: Worldviews, World Scientific, 2006, pp. 543–578.
[3] A. A. C. Amorim, “Multimédia: um conceito em evolução,” Revista Portuguesa de Educação, vol. 15, no. 1, pp. 245–268, 2002.
[4] S. Suwarno, N. Ibrahim, and U. A. Chaeruman, “Mapping scientific research on hypermedia learning technology using Scopus database: A bibliometric approach,” Library Philosophy and Practice (e-journal), pp. 1–20, 2021.
[5] J. Raper, “Progress towards spatial multimedia,” in Geographic Information Research, CRC Press, 2020, pp. 525–543.
[6] M. S. Akhter, A. Zafar, and N. Saba, “Evaluation of Integrated ESP Course Using Hypermedia Software for Effective Learning and Teaching in Pakistan,” Indian Journal of Economics and Business, vol. 21, no. 3, 2022.
[7] K. O. Vasylivna, I. Lelet, V. Serebriakova, and S. Yukhymets, “The Use of Hypermedia Technologies in Higher Education Institutions during Covid Lockdown”.
[8] L. S. Del Río, C. V. Sanz, and N. D. Búcari, “Incidence of a hypermedia educational material on the Teaching and Learning of Mathematics,” Journal of New Approaches in Educational Research, vol. 8, no. 1, pp. 50–57, 2019.
[9] R. Maulana and S. Hidayati, “The DEVELOPMENT OF HYPERMEDIA LEARNING MEDIA IN AN EFFORT TO IMPROVE HIGH ER ORDER THINKING SKILLSS STUDENTS IN HIGH SCHOOL ECONOMICS CLASS X SUBJECTS: learning media, hypermedia, higher order thinking skills,” PEKA, vol. 10, no. 2, pp. 34–44, 2022.
[10] M. Ahmad, N. R. Mansor, R. A. Rashid, N. Ain, C. R. Zakaria, and C. M. Sung, “Implementation of digital games in advancing students’ higher-order thinking skills: A review,” presented at the Journal of Physics: Conference Series, IOP Publishing, 2021, p. 012069.

[11] D. Birch, M. Sankey, and M. Gardiner, "The impact of multiple representations of content using multimedia on learning outcomes," International Journal of Instructional technology and distance learning, vol. 7, no. 4, pp. 3–19, 2010.
[12] E. E. Achor, "Integrating technologies in curriculum development," Journal of Curriculum and Instruction, vol. 13, no. 2022, pp. 4–33, 2022.
[13] C. Ikram, E. Mohamed, and K. Mohamed, "Enhancing Adaptive Pedagogical Content Development with ADDIE and Scrum in Hypermedia Environments," DIROSAT: Journal of Education, Social Sciences & Humanities, vol. 2, no. 2, pp. 63–72, 2024.
[14] B. Wibawa and M. Winarsih, "The Development of Hypermedia Based E-Book for Integral Calculus Subject.," International Journal of Online & Biomedical Engineering, vol. 16, no. 4, 2020.
[15] H. G. Weller, J. Repman, and G. E. Rooze, "The relationship of learning, behavior, and cognitive style in hypermedia-based instruction: Implications for design of HBI," in Multimedia and Megachange, CRC Press, 2020, pp. 401–420.
[16] M. Kovtoniuk, O. Kosovets, O. Soia, and L. Tyutyun, "Virtual learning environments: major trends in the use of modern digital technologies in higher education institutions," Educational Technology Quarterly, vol. 2022, no. 3, pp. 183–202, 2022.
[17] V. Dobrica, L. Duško, and V. S. Lj, "Use of information technologies in higher education from the aspect of management," International Journal of Cognitive Research in Science, Engineering and Education, vol. 11, no. 1, pp. 143–151, 2023.
[18] O. B. Adedoyin and E. Soykan, "Covid-19 pandemic and online learning: the challenges and opportunities," Interactive learning environments, vol. 31, no. 2, pp. 863–875, 2023.
[19] Z. Lassoued, M. Alhendawi, and R. Bashitialshaaer, "An exploratory study of the obstacles for achieving quality in distance learning during the COVID-19 pandemic," Education sciences, vol. 10, no. 9, p. 232, 2020.
[20] C. Pahl, "A taxonomy for interactive educational multimedia," presented at the EdMedia+ Innovate Learning, Association for the Advancement of Computing in Education (AACE), 2004, pp. 610–617.
[21] H. El Kabtane, M. El Adnani, M. Sadgal, and Y. Mourdi, "Toward an occluded augmented reality framework in e-learning platforms for practical activities," Journal of Engineering Science and Technology, vol. 13, no. 2, pp. 394–408, 2018.
[22] S. Wu, "Application of multimedia technology to innovative vocational education on learning satisfaction in China," PLoS One, vol. 19, no. 2, p. e0298861, 2024.
[23] C. Ikram, E. Mohamed, A. Souhaib, and K. Mohamed, "Integration of pedagogical videos as learning object in an adaptive educational hypermedia systems according to the learner profile," International Journal of Computer Trends and Technology, vol. 69, no. 6, pp. 1–6, 2021.
[24] F. Fischer, P. Troendle, and H. Mandl, "Using the internet to improve university education: problem-oriented web-based learning with MUNICS," Interactive Learning Environments, vol. 11, no. 3, pp. 193–214, 2003.
[25] H. J. Chokshi and R. Panchal, "Using Apache Jena Fuseki Server for Execution of SPARQL Queries in Job Search Ontology Using Semantic Technology," International Journal of Innovative Research in Computer Science & Technology, vol. 10, no. 2, pp. 497–504, 2022.
[26] W. A. Holness, "Access to Justice for Mothers with Intellectual Disabilities in Cases of Child Neglect at two Kwazulu-Natal Children's Courts," 2021.
[27] W. M. Reed and J. K. Burton, Multimedia and megachange: new roles for educational computing. CRC Press, 2020.
[28] A. Alzubi, "The role of multimedia tools in Hashemite Kingdom of Jordan education classroom teaching in the digital era," European Journal of Interactive Multimedia and Education, vol. 4, no. 2, p. e02303, 2023.