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RESEARCH PAPER

Review of Linked Data and Open Educational Resources in Academia: Potential Benefits and Challenges

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ABSTRACT

This study aims to establish the importance of open educational resources through linked data among academics in higher educational institutes. This paper examines the potential benefits and challenges of using linked data technologies for open educational resources (OERs) in university academics. This study is based on a descriptive literature review published in national and international literature. This study demonstrated that the use of linked data to integrate open educational resources supported university academia in improving learning, teaching, and research activities. The relevant literature established the dynamic role of linked data for the enhancement of open educational resources and associated potential benefits and multiple challenges by the academia. The study sensitizes the educational institute's administration to take initiatives for the open educational resources in terms of open education, open repository and open courseware. The results of the study develop the understanding of students, teachers and information professional in higher education institutes locally and internationally. Moreover, this study provides the recommendations to investigate this phenomenon in depth in order to apply linked data in the academic setting. In this era of information and communication technology where the web has become increasingly important. These phases include open research, open sciences, and open educational resources that incorporate linked data require in-depth examination in in local perspective to become more visible in academia.

KEYWORDS: eLearning, Linked Data, Linked Services, OER, Semantic Web, Technology-enhanced Learning

Introduction

Open educational resources (OERs) are a relatively new development in educational institutions. In this age of information and communication technology, the Web has taken the central place, and electronic contents are proffered to read. Linked data has changed the way of teaching and learning for the people associated with education. Open educational resources quickly becoming significant components of higher education. Open educational resources with linked data can be effective tools for professional development, teacher cooperation, and improving student outcomes.

The widely accepted definition of open educational resources (Downes, 2011) is as follows: "Open educational resources are materials used to support education that may be freely accessed, reused, modified, and shared by anyone."

Access to knowledge and other educational content is necessary to improve teaching, and lifelong learning and to enhance personalized learning (William and Flora

Hewlett Foundation, 2013). In open educational resources content including scholarly publications and open-access textbooks etc (McGreal et al., 2015).

Open educational resources, according to UNESCO (2019) are teaching, learning, and research materials in any medium (digital or otherwise) that are either in the public domain or have been distributed under an open license that allows anyone to use, adapt, and redistribute the others free and without any restrictions. Open educational resources are included in the category of 'open solutions,' which also includes free and open-source software, open educational resources, and Open Access.

In the general conference of UNESCO (2019) open educational resources were overwhelmingly endorsed, which encourages the invention, use, and adaption of inclusive high-quality open educational resources and fosters international cooperation in this sector.

There are two types of spaces in learning areas: learning space and lab space. A learning space is a location where freely available educational resources are organized, networking technologies are connected, and a collaborative environment is created. There are multiple activities related to open educational resources i.e., content creation, repurposing, and remixing (Mikroyannidis, 2011).

Open educational resources (OER) are academic content/materials based on the Internet that are used for academic purposes by instructors, students, and researchers in the 21st century the era of the knowledge economy. As a result of recognizing knowledge and educational material as "public commodities" everyone has free access to the content that best suits their requirements.

OER in Academia

Open educational resources development and exchange the content in academia is a dire need in the present era. There is a great technological impact on educational resources and their consumers and creators.

Supporters of open educational resources believe that free and open sharing of educational resources is essential for the development of ubiquitous learning networks and the decrease of information that divides society. (McGreal, Kinuthia, and Marshall, 2013, p. xviii). McGreal (2011) claimed that open educational resources can be valuable resources for students and academics, dependent on the quality of the resources housed in the repositories.

The success of linking open educational resources in academia is based on the capacity and the capability of the consumer and creator of educational content to effectively create, distribute, discover, and reuse the quality of resources.

Literature Review

Linked data and OER: Linked data improve faceted searching. Nahhas et al. (2018) described two educational values (knowing and sharing) and related data in perfect harmony. Many studies have found that linked data played a vital role in promoting and improving education. Many international academic institutes have undertaken projects such as massive open education repositories, Open Courseware (OCW), and Massive Open Online Courses (MOOCs) while using the linked data.

Piedra et al. (2013) emphasized on optimum sharing of open-access publishing. Any open instructive information activity has to focus on providing access to information for the purpose of learning. Navarrete and LujanMora (2015) conducted a survey on

linked data in education and presented the perspective of enriching open educational resources with a focus on the description of technology.

Guy (2016) established that open educational resources (OER) support the goal of open educational data, a subset of OERs in which datasets are created and shared for learning and teaching. Downes, (2011) defined open educational resources (OER) as "Materials used to promote education that may be openly accessed, reused, updated, and shared by anyone". The proliferation of projects, information campaigns, and the rise of institutions that support the ideology of open educational content.

Hewlett Foundation has been one of the key donors of the open educational resource movement. More than $68 million had been committed by the Foundation towards open education projects and organizations (Atkins, Seely Brown, & Hammond, 2007).

UNESCO (2012) published the Paris open educational resources declaration and encourages institutions to create platforms for the dissemination of open educational resources. Hylén (2005) pointed out open education resources (OER) initiatives as follows:

- Open courseware and content.
- Open software tools (e.g., learning management systems).
- Open material for e-learning capacity building of faculty staff.
- Repositories of learning objects.
- Free educational courses.

Open courseware and content

This concept of open courseware demonstrates the importance of open educational resources. Open courseware is based on the philosophical view of knowledge as a collective social product desired by society to make it social property. As part of the UNESCO discussion on open educational materials, it was suggested that a global index system would be established to facilitate potential users in finding courseware and making it easily available (UNESCO, 2002a).

Open software tools (learning management systems)

In learning management systems, open software tools play a significant role in creating and editing digital content that can be used as open educational resources. There is a wide variety of open software tools in low-tech and high-tech available to make open educational resources more accessible in academia.

Open material for e-learning capacity building of faculty

With the combination of OERs and information communications technologies, academic staff capacity building in e-learning can be improved in any educational institute. Open educational resources help academic staff develop the skills they need to help their students with teaching and learning.

Repositories of learning objects

The learning objectives of initiatives for OERs are to make repositories of educational materials in a structured and meaningful way. It is ultimately tied to educational objectives and learning.

Free educational courses

With the help of ICT and OERs the universities around the globe offer free educational courses to facilitate the students. It is a drastic change in higher education decreasing prices and increasing access. In 1913 Thomas Friedman, defined in an article "Revolutions hit the Universities" in The New York Times, "nothing has greater potential to lift more people out of poverty" and to "unlock a billion more brains to solve the world's biggest problems".

Potential Benefits

- The study derived various benefits reported in the literature towards the linked open educational resources as follows.
- Benefits for the Government, Institutional, and learners' perspective
- Teachers' innovation in their teaching and research
- Improve academic performance and save the money of the students.
- Impact on educational policies
- Improving new skills sets
- Integration of educational data, educational systems, and interoperability.

D'Antoni (2009) outlined the benefits of open educational resources from the perspectives of various stakeholders. He expresses his views towards OERs, which are freely and publicly available for educators, students, and self-learners to use and reuse for teaching, learning, and research.

Hodgkinson-Williams (2010), illustrates how different groups can benefit from open educational resources (OER) i.e. (i) Government perspective for expanding access to nontraditional learners and filling the gap between formal and informal education. (ii) Institution's perspective such as improving the collaboration among students, faculties, and other institutes. (iii) Educators' perspective i.e., fostering with colleagues and institutes and improving the teaching innovations and (iv) Learners' perspectives gain the high-quality material from the top universities of the word.

Teachers might use open educational resources on the web for their students and research activities. Learners use these educational resources to enhance their learning and improve their knowledge in their field of study.

Bates (2011) found that open educational resources are useful for students and teachers to use, as well as being accessible in a variety of ways, and are more open to contextualization than private materials. Open educational resources could be used in any of the various techniques that are being developed to encourage open learning.

Various studies have shown that the implementations of open educational resources improve academic performance in addition to saving money for the students (Bowen,Chingos, Lack, & Nygren, 2014, Feldstein et al. 2012; Hilton and Laman, 2012; Lovett, Meyer, and Thille, 2008).

Open educational resources have a significant impact on educational policies, with potential benefits including fostering innovation, promoting the concept of lifelong learning, improving the quality and flexibility of resources, and increasing the image of the institutes. (OECD 2007; Yuan, MacNeil, and Kraan 2008; McGill, et al 2010; McGill et al 2013).

Sandanayake (2019) stated that open educational resources based on blended learning are being evaluated and emphasized the same practice for OER. The researchers

and educators will be able to become more imaginative in their teaching and learning as a result of their use of free educational resources.

Lnenicka et al. (2020) pointed out that the notion of openness and information sharing (linking) has a significant impact on the educational system due to the vast amount of data available. In academia, there is a debate about how to effectively deal with linked data. The authors investigated the use of big and open-linked data for the educational process in order to develop a new set of skills.

Pereira et al. (2018) identify the following goals for publishing linked data in the context of education i.e., connecting educational data, educational system integration and interoperability, and connected data consumption for a variety of educational purposes. The study compiles a systematic list of ideas that have been used to link data for supporting the educational content.

Nahhas, et al. (2018) described two educational values (knowing and sharing) and related data in perfect harmony. Studies found that linked data played an important role in promoting and improving education. Many international academic institutes have undertaken projects such as massive open education repositories, Open Courseware (OCW), and Massive Open Online Courses (MOOCs) while using the linked data.

Challenges

- The study extracted multiple challenges reported in the literature regarding the OERs as follows.
- Apathetic Attitude
- Data integrations
- Dealing with constant change
- Enriching and interlinking unstructured metadata
- Interpretability and standards
- Language issues
- Affordability
- Reluctance of sharing
- Lack of training
- Lack of awareness
- Copyright issues
- There are many reasons for this apathetic attitude toward sharing. First many faculty members are happy to share their work; many are unaware of how to preserve their intellectual property rights (Hylen, 2006; Yuan, MacNeill, &Kraan, 2008).

According to Pereira et al. (2018), Linked data standards and developments are being investigated in several countries. Although there are several challenges faced in the process of integrating liked data in education, the issues can encourage future research in this field.

Dietze et al. (2013) investigated the problems and techniques to connecting educational resources, as well as the abundance of LD that currently exists on the Internet. The authors discussed the four main challenges to establishing web-based connectivity with educational resources i.e. (i) data integration (ii) dealing with the constant change (iii) enriching and interlinking unstructured metadata and (iv) mediating and altering metadata that define resources.

Farzand and Fatima (2020) discussed some of the challenges and benefits of using connected data in education. The study's findings revealed that interoperability and

standards challenges exist, but these may be resolved by starting with linked data principles.

In linked data, the concept of "openness" is complicated and not a black-and-white issue; a spectrum of resource openness is emerging. For enriching and leveraging this spectrum in the future, there will be possibilities and obstacles (Atkins, Brown, and Hammond, 2007).

According to Cobo (2013), open education research and discussions primarily focus on English-speaking communities, which provide a hurdle to ensuring universal usage or understanding of content for non-English speakers**.**

Navarrete and Lujan-Mora (2015) outlined that constant changes are major challenges which are needed to be updated in the set of linked data. AAC&U (2018) highlighted the challenges faced by the higher educational institutes today such as affordability, retention and completion, and the quality of learning by the student.

Kanjilal (2013) outlined that the financial aspect of broadband, hardware, and software are big difficulties in covering the cost of the creation of open educational resources. According to another study, teachers are reluctant to share educational content and are not satisfied to use the resources produced by others (Hodgkinson and Williams, 2010).

Navarrete and Lujan-Mora (2015) reported that there is a need of organizing the state of how people, groups, and activities are organized. Controlling and updating these things are the major problem in using linked data in education.

Education Movement brings dramatic changes in learning and teaching patterns, although not without challenges (Hodgkinson-Williams, 2010). As stated in another study "ensuring a high standard of education for all learners through open education means their inclusion in lifelong learning processes, the attainment of human potential and achievement of meaningful knowledge" (Blessinger and Bliss, 2016 p. 168).

Last, in the legal domain some challenges are i.e., lack of awareness, copyright issues, and the modification of materials and licenses. It is really critical to address these problems with professional development training for an in-depth understanding of open educational resources.

In this paper, the literature is reviewed on the application of links in an educational context. Linked data describes a method of publishing data so that it can be interpretable and reusable by machines and humans. Data from different sources are connected and queried through the use of technologies such as RDF Web to describe the information and the 5 Star deployment scheme to improve the quality of data for publically use.

Material and Methods

The study is a descriptive review based on available published literature on national and international platforms. The majority of the articles covered linked data and open educational resources. To explore this topic different databases i.e. Library and information science abstracts, library, information science and technology abstracts, Google Scholar and EBSCOhost were also consulted to search the literature for this purpose. The relevant literature established the dynamic role of linked data for the enhancement of open educational resources and associated potential benefits and challenges.

OERs build by the different stakeholders of the academia such as faculty, students, administrators, and librarians. A large group of people committed and dedicated to the resource's long-term sustainability reviews, revises, reworks, remixes, and frequently updates some open resources.

Results and Discussion

According to the reviewed literature following results and discussion are made. There are multiple educational contents being published and offered by the universities. Open educational resources which included videos, presentations, lectures, books, and games as well as the publication of tools to support educational practices. The results of the study demonstrated that soft and hard skills are the key factors for the scholarly community.

The results of the studies demonstrated that linked data played an important role in promoting and improving education and facilitating faceted searching. (Nahhas et al. (2018) emphasized openness for the purpose of teaching and learning (Piedra et al. (2013). A study was conducted for enhancing open educational resources with a focus on technology description (Navarrete and LujanMora, 2015). Open educational resources support the goal of education (Guy ,2016).

Most of the studies demonstrated the potential benefits of integrating educational resources for students, teachers, and researchers. Linking educational resources can help students to enhance their academic performance, saving time and money. Openness and linking information and sharing have a significant impact on educational institutes for instance in policymaking, designing educational programs, encouraging innovation, and promoting the concept of life learning and decision-making. (D'Antoni ,2009; Bates, 2011; Bowen, Chingos, Lack, & Nygren, 2014; Feldstein et al., 2012; Hilton &Laman, 2012; OECD 2007; Yuan, MacNeil& Kraan 2008; McGill, et al 2010; McGill et al 2013a; Lnenicka et al, 2020).

Researchers are investigating linked data, standards, and improvements in the different origins of the world (Pereira et al. 2018), There are multiple challenges in linking educational resources on the web (i) data integration and distribution among heterogeneous educational repositories (ii) dealing with continuous changes existing in the repositories (iii) enriching and interlinking unstructured metadata and (iv) mediating and altering metadata that defines resources (Dietze et al, 2013). There is revealed that interoperability and standards challenges exist (Farzand and Fatima ,2020). Language is a hurdle to ensuring universal usage or understanding of content (Cobo , 2013). There is a great challenge of affordability, retention, completion, and quality of student learning (AAC&U, 2018).

The role of teachers in managing educational resources with a strong emphasis on the ability to understand relevant data sources, interpret their value and establish educational processes to engage other stakeholders and transfer knowledge. Linking open educational resources is important for the learning process since it allows for communication, cooperation, negotiation, and knowledge exchange, among other things.

Conclusion

Open educational resources started to develop the process of learning objectives. The relevant studies on this topic are insufficient to provide more inclusive reviews. In the educational context, multiple studies on linked data were reviewed to cover the topic. In academia, linked data brought up many benefits including transparency, reusability, knowledge discovery, and interoperability for various application areas. The study is presented in three parts: (1) the first part presents an overview of the role of linked data

in promoting open educational resources. It provides a concise summary of improving the educational content for academia. (2) The second part presents a discussion of the multiple studies on the potential benefits for academia to adopt linked data technologies with open educational resources. (3) The third and final part of the study presents the varied challenges involved in adopting LD technologies with open educational resources.

Finally, the educational community might encourage students and teachers to use open educational resources with linked data to improve their efficiency and effectiveness in searching for educational content. The accessible and approachable educational content will cause the quality of education and research activities in academia.

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