OERs Integrated with AI in Science Education Prospects and Challenges

Pulluru Savitha
Lecturer in Botany
Government Degree College, Godavarikhani, Telangana

Abstract

To stabilize education in pandemic situations, focusing on OERs has led to the invention of a novel type of pedagogy for students of various disciplines and at various levels. Previously, libraries were the only sources for getting deep knowledge on a subject. But libraries may not be in reach of the students in remote areas. Also, not all libraries have updated books, and buying updated books is a more costly process for students from lower socioeconomic backgrounds. Now, as OER integration with AI has taken flight, students from lower levels to higher levels and students from remote areas to urban areas, students from different backgrounds and economic groups are benefiting from this. Many students drop out of their studies to put their hands to work in carrying on their livelihood. Moreover, science education with practical knowledge is just like an unachievable dream to them. Even for students who need deep knowledge with practical insight, they may not be satisfied due to fewer resources for practical knowledge, and space and time may also be limitations. Hence, to overcome all these real-world problems, various certified and instructor-based OERs or AI-assisted OERs have stretched their hands to support the students. OER also creates the opportunity to form communities around teaching and learning through the material production, adaptation, and resharing process (Carrie Diaz Eaton).[1] Focusing on the area of study of life sciences, in this area, many OER platforms are giving their best to satisfy every level of learner in society by providing openly licensed digital materials, including books, virtual labs, simulated interactive sessions, and open research articles supporting teaching, learning, and research. But the use of these resources in a constructive way, addressing the ethical considerations to stabilize the education system, should be the main motto of the educators, rather than passively adopting them. Also, many of the platforms are paid access, which is out of reach for the learners. Hence, the gaps of the OERs should be wiped out with vast usage and accessibility to many with low cost and more content.

Keywords: Pedagogy; virtual labs; simulations; constructive; accessible; ethical

Introduction

The United Nations Educational, Scientific, and Cultural Organisation describes OERs as "teaching, learning, and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open licence that permits no-cost access, use, adaptation, and redistribution by others with no or limited restrictions" **(UNESCO, 2022).**[2] Teachers in science education play a monumental role not only in imparting scientific skills to students but also in fostering the inquisitiveness, engagement, and perseverance required for excellence **(Fauth et al., 2019; Ben Ouahi et al., 2022).**[3] To realise its full potential, however, teachers must be equipped to select and effectively use digital tools that enhance learning, especially in subjects like science. As establishment costs are a barrier for educators to carry on with science experiments, virtual labs may prove to be beneficial in this context. Also, for students below the poverty line with a quest to pursue science education, the OERs in science education are a boon to their inquiry, experimentation, and real-world application (**Angeli & Valanides, 2005**).[4] It is no wonder the future will be a virtual world, with education becoming so simple and perceived in one's own drawing room. No conveyance problems, no formal

dressing problems; no need to spend much on your shoes, enjoy a homely atmosphere, and have your mother and father moving around, even amidst grandparents. Life becomes easier, and a constructive environment of healthy families may be established in society.

Objectives

The present study aims to analyse the role of AI-integrated Open Educational Resources in science education. The specific objectives of the study are:

1. To examine the significance of Open Educational Resources in science education.
2. To analyse the role of Artificial Intelligence in enhancing OER-based learning environments.
3. To identify the major prospects of AI-enabled OER platforms for science teaching and learning.
4. To examine the challenges and limitations associated with the use of OERs in science education.
5. To suggest strategies for the effective integration of OERs and AI technologies in educational practices.

Methodology Adopted

To know the prospects and challenges, I've gone through various articles and gathered information about the benefits of OERs and how they change the educational scenario by framing different pedagogical models. Also, a questionnaire of Google Forms with some questions on the usage of OERs, platforms used more by them, in what way OERs helped them, and their opinion or perspective on using these platforms was circulated among some of the science faculty. The questionnaire and review of various articles reveal the following prospects and challenges of OERs in science education.

Prospects

A revolution with the digitalisation of education is the current scenario through which global competency has become a job in one's own hands. With the advent of OERs, educational barriers with the limitations of time and space have lost their pace. Open access to information will undoubtedly improve the availability of scientific publications and also lower costs. As a result of libraries' inability to provide information seekers with the anticipated academic publications they want, their value has significantly decreased in recent years **(Ivwighreghweta 2012).** The thirst of a learner is ultimately gaining importance, and various learner-friendly platforms with their Creative Commons are emerging day by day. OERs have changed the entire educational framework for providing concept-based education to learners at all levels and from varied socioeconomic backgrounds. Many of the intellectual people of the society are investing their knowledge capital in framing the process of using different OER platforms. In this context,

Dr David Willey's key legal permission for enabling users with the 5R.s framework of retain, reuse, revise, remix, and redistribute has become the backbone of various learners and educators

throughout the globe. An overall review and analysis of OERs is a very tedious process, as this subject is an emerging one and needs awareness of exploring the processes of using these platforms. According to **Allen & Seaman (2014)[5],** the majority of faculty members regarded open educational resources (OER) as being on par with or better than conventional resources in terms of cost (97.9%), effectiveness (84.6%), efficacy (91.2%), and trustworthy quality (73.6%).

According to **Ogunbodede and Mohammad (2022)[6],** access to the archives of many educational institutions on a local and international level has made OER a reality for the majority of academics. By reducing geographic, economic, and demographic barriers to education, OER may support individualised learning and lifelong learning on a global scale. OER has not yet been practised in a larger context for knowledge-building or sharing purposes due to the boundary between traditional and open education approaches and mounting digital inequalities and socio-economic, political, and cultural barriers. Also, lack of awareness and policy practices are believed to have obstructed OER practices **(Munir Moosa Sadruddin, 2022).[7]** Moreover, integration of AI with OERs is now a blooming reality where accessing and availability of OERs with AI have a variety of educational applications, such as personalised learning platforms to promote students' learning, automated assessment systems to aid teachers, and facial recognition systems to generate insights about learners' behaviours (Selin Akgun).[8] Many platforms have created attractive pedagogical models for disseminating to the aspirants. Science education has not remained confined to those old walls with broken windows, insufficiently spacious labs, and the non-availability of advanced laboratory equipment, with cost being a barrier. Recent trends of OERs integrated with AI have updated virtual labs, simulations, and models,

even with instructors mentoring 24/7 with no time constraints. Some of the platforms with their courseware, virtual labs, simulations, etc., are

- Virtual Science Labs and Simulations: Labster, LabXchange, and Gizmos provide practical insight to the learners without a physical approach
- Tutoring and adaptive platforms: Khan Academy, Knewton Alta,
- Cognil, Embib, Swayam, with various coordinators like NPTEL, AICTE, NIOS, IGNOU, etc.
- General AI-powered study tools: Socratic by Google, Drift, Quizlet, ChatGPT, Gemini, etc.
- Content creation and interactive learning platforms are Curipod, Mergecube, etc.

On analysis, most of the faculty members are educators and learners using various platforms like MIT Courseware and ChemDraw for simulations and models; virtual labs for inserting the practical knowledge, Labster, **SWAYAM** content and instructor-based courses; and **GAD-TLC** and Ramanujan colleges offering various teacher training online programmes with hands-on training and Byjus learning material for guiding the students to NEET and JEE preparations. Most of the learners completed their PhD work with the help of various OER content. Widely used platforms such as Kahoot!, Canva, Flipgrid, Edmodo, Google Slides, and Quizizz—along with Web 2.0 tools like YouTube and Facebook—have made it easier for teachers to enhance instruction and share best practices (**Neo et al., 2013**). Most of the students who are irregular in their live classes are going through the content and lessons uploaded on YouTube and various platforms.

Challenges

We are experiencing an amazing transformation of educational pedagogical methods. OERs integrated with AI have changed the scenario of the framework of education. But some of the challenges revolve around these pedagogical methods, where concern should be given to address these challenges in a sophisticated way and give the stakeholders a worthy experience. One of the main challenges remains the data privacy concern. As educational institutions increasingly rely on digital platforms and AI tools, policies need to establish clear frameworks for data privacy, security, and responsible use of information in open education. This includes developing clear guidelines for data collection and use in open educational environments while adhering to privacy regulations and ethical standards. This practice supports the integrity of OER (Tianchong Wang and Sanjaya Mishra, 24 January 2025).[9] Access to remote areas with no proper internet facilities is also a limitation. Although OER initiatives have successfully removed cost barriers by making a wide range of materials freely available, ensuring these resources are truly accessible and effectively support diverse learners remains a key priority, especially for underserved communities. (Tianchong Wang and Sanjaya Mishra, 24 January 2025). Teachers should be prepared to use and operate various platforms of OERs so that better dissemination of the content can be made to the learners.

Understanding the usage of these platforms needs training for educators or instructors. Inserting practical insights through OERs is a benefit to some extent, but when integrated with live practical sessions, they prove to be more fruitful. Hence, keeping in view the availability, time constraints, and spatial barriers, dissemination methods should be designed. Relying more on the AI tools and OERs may make the brain numb, lose the power of thinking, and fail to grasp the concepts. It may be that just our fingers remain clicking on the keyboard for even small things, for which there is no need to depend on OERs with AI.

Conclusion

It is no exaggeration to say that digital technology is advancing rapidly, with its feathers spread to support all areas of education. But along with these advancements, policies should be framed for sustainable education to meet the concerns about privacy and ethical issues and also socio-economic issues. Advanced techniques to check plagiarism and copyright issues should be used to safeguard the research prospects of the authors or owners. Internet accessibility issues should be looked into to provide the fruits of these advanced pedagogical methods to all levels of learners and educators, removing the time constraints and spatial and economic barriers. Moreover, blended OERs should be given focus, as, always, a teacher besides you will help in every walk of your journey in education. Overall, OERs integrated with AI should be a support in wiping out the anomalies in education and providing sustainable and self-sufficient platforms to compete with the global standards.

References

1. Allen, I. E., & Seaman, J. (2014). *Opening the Curriculum: Open Educational Resources in U.S. Higher Education.*
2. Angeli, C., & Valanides, N. (2005). ICT-related pedagogical content knowledge: A model for teacher development. *Computers and Education.*
3. Fauth, B., Decristan, J., Rieser, S., Klieme, E., & Büttner, G. (2019). The effects of teacher competence on student outcomes. *Teaching and Teacher Education.*
4. Ogunbodede, K. F., & Mohammad, A. (2022). Relationship between awareness and use of Open Educational Resources.
5. Sadruddin, M. M. (2022). Opportunities and challenges of open educational resources.
6. Akgun, S. Artificial intelligence in education: Addressing ethical challenges in K–12 settings.
7. Wang, T., & Mishra, S. (2025). Charting a course for open educational resources in the AI era.
8. UNESCO (2022). *Open Educational Resources Recommendation.*