Bodhi International Journal of
Research in Humanities, Arts and Science

Vol. 10 Special Issue 1 March 2026
E-ISSN: 2456-5571

Biology Teaching in Secondary Schools through Digital Mode

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Crossref doi

Open Access

Manuscript ID:
BIJ-SPL1-MAR26-EDU-042

Subject: Education

Received : 23.01.2026
Accepted : 04.02.2026
Published : 14.03.2026

DOI: 10.64938/bijsi.v10si1.26.Mar042

Abstract

Biology teaching in this new era has vital role and every learner has to have adequate knowledge on living organism of the universe. The paper aims to provide some important highlights on the teaching and learning of biology subject at school level with reference to digital transformation. Further, the authors reviewed some selected studies on this line for more understanding on usage of digital modes in biology education. Some outlines on digital tools and platforms are also provided in this paper. Apart from this, the author discussed about the benefits and challenges in using digital modes in teaching biology at school level.

Keywords: biology teaching, digital tools, secondary school students, teaching strategies.

Introduction

Teaching is more than just delivering information to a secondary school students and individuals. It is both an art a science to teach biology. Teaching biology enhances the scientific knowledge and understanding the educational methodology in current scenario. As technology and science improve, there is indeed a paradigm change in the teaching and learning process. Digital biology teaching in secondary schools has shifted from a supplementary tool to a core instructional mode. Current implementations focus on visualizing abstract concepts through interactive simulations, virtual labs and AI - driven platforms. The digital competences of framework for citizens-DigComp 2.2 (Vuorikari et al. (2022) clearly denotes that the areas and digital competences of citizens and it is therefore necessary to focus on them in education across different subjects. The main use of learning digital mode is to improving learning and besides for evolving digital competencies among student learners in all areas of the DigComp charter. The usefulness of digital models, simulations, databases, mobile applications, videos and image analysis or programming are significant not only for refining student learning, but also for emerging students digital competencies in all areas of the DigComp charter.

Literature Review on Digital Mode of Education

According to the study findings of Mišianiková, A., & Lešková, A. (2023), the learners of today might be developed in 21st century skills such as rational thinking, inventiveness, teamwork, communication, digital literacies, creativities, efficiency and communal skills through their academics with usage of digital transformation.

The specific purpose of the study of Chukwuemeka (2025) was to assess the role of digital tools in enhancing collaborative learning and teamwork in biology class at secondary level and to identify the most effective and accessible digital tools. Based on the findings of the study, the researcher accomplishes that digital utensils would be united in teaching and learning of biology in school education.

The Use of Digital Technologies in the Teaching of Biology at Primary and Secondary Schools was studied by Lešková et al. (2025). By using digital tools, the student learners obtain a greater variety of acquaintance, which is shaped from numerous Internet bases and readings, where they chat knowledge with each other more rapidly through communal grids, such as, e-mail or various educational platforms such as Microsoft Teams, Zoom, Messenger and others. The study also emphases on analysis of biology lessons in the procedure of observation records, through which we required to regulate the level of use of digital skills.

A study in secondary schools of Benue state, Nigeria was carried out by Ogah et al. (2025) to evaluate the digital technology incorporation in Biology education. The study highlights the need for augmented investment in digital technologies and teacher training to improve the excellence of biology education in schools.

Digital Tools and Platforms

The following are the digital tools and platforms that can be easily used by both the student learners and teachers for teaching learning purposes in biology subject.

Virtual Laboratories

Tools like Labster and PhET Interactive simulations allow students to perform complex experiments like DNA extraction, cardiovascular analysis in a risk-free environment, providing immediate feedback.

AR Tools and 3 D Visuals

Platforms like BioDigital provide immersive 3D experiences of the human body, while Augmented Reality (AR) helps visualize microscopic structures like cell division and protein sequences in real-time.

Learning Management Systems (LMS)

Moodle and Google Classroom are used by over 67% of biology teachers in some regions to mange collaborative and conceptual learning.

Gamification Tools

Interactive quiz platforms like Kahoot, Quizizz and Blooket are frequently used to enhance student motivation and check for understanding.

Key Teaching Learning Strategies in Biology Teaching

The following are the key teaching and learning strategies mostly used by the present day teachers of biology subject.

Interactive Teaching Mode

Shifting from “Sage on the stage” to a “guide on the side,” where the teacher facilitates students’ exploration of digital content during the biology classroom learning environments.

Blended Learning

It recommends the teachers to combine both the traditional face-to-face instruction and online models while teaching biology subject and in that roughly 30-79% of content is delivered digitally.

Modular Teaching

It means that the usage of pre-designed digital modules along with the specific curriculum topics. (e.g., Cell organelles) to improve academic performance of the student learners in biology subject.

Story Telling

It denotes the integration of biological concepts into story lines and through that the teachers can facilitate the students to have an increased memory by up to 20 times.

Benefits and Challenges of Digital mode of Learning

While using the digital mode in teaching biology subject, it will be easier to teachers to visualize the invisible or abstract concepts (e.g., molecular structures) and hence it enhances the students' involvement in learning and also they will be engaged properly in their subject learning. Further, it will improve the ability in understanding the concepts easily through the conduction of experiments.

Digital challenges in secondary school learning include significant infrastructure gaps (poor internet/electricity), lack of teacher and student digital skills and high costs of technology. These issues, compounded by screen fatigue and reduced face-to-face interaction, create substantial hurdles for effective, equitable and engaging online education.

Conclusion

School education meant for inculcating the needed academic competencies among the learners through varieties of learning experiences in their learning environment. Particularly, the school system must focus to develop the STEM competencies among the learners, why because; these competencies science, technology, engineering and mathematics are all the very much needed competencies in this present digital era. In that way, our school curriculum also needs to be modified to bridge the student learners' learning gap. All the learning experiences must be blended with the use of digital technology. Further, curricular contents should be designed in different language to increase their reach and more opportunities for youth of rural India.

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