Horizons of Holistic Education
July-Sept.,-2021, 8 (3), 132-139

p ISSN : 2349-8811
eISSN : 2349-9133

Applicability, Opportunities, and Challenges in Integration of Information and Communication Technology on Science Education

Jayveer Singh

jayveern50@gmail.com

Department of Education

Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya. Wardha, Maharashtra-India

https://orcid.org/0000-0003-4627-3226

Received: 15.06.2021 Accepted: 25.07.2021

Abstract

Integration of Information and communication technology (ICT) in teaching-learning of science enhances the pedagogical enrichment of scientific facts. Modern tools of communication technology are capable of creating teaching-learning scenarios from anywhere (it means At Home, School, Collage, Institute, and other types of organization) and learners can access science learning from without physical limitations. Because at present, learners, teachers and educators are showing high expectations on ICT integration in science education.

This paper tell us about the these objective such as: (1)To identify the applicability of integration of ICT (2) To identify the opportunities' of integration of ICT (3) To identify the basic efficiency/accountability of integration of ICT (4) To identify the barrier's in integration of ICT in Science Education. The reviewed paper in this study are collected from Google scholar and open search on the Google, with the inputting words related to title. Findings suggested with help of deep reviewing reference articles and papers

The research tells about the applicability's, opportunities, and barriers' in process Integration of information and communication technology on science education and relationship between competency and confidence between the pedagogy and science concepts. At present scenario, educational world are promoting science education through the integration of ICT using the SWAYAM, MOOCs, Commonwealth of learning platform etc. They also introduce many degree, diploma, and certificate courses in science and other disciplines of knowledge. Therefore we must need to aware about the applications, opportunities and challenges in integration of ICT in science education.

Key Words: Information Communication and Technology(ICT), Science, Integration, Opportunities, Applicability, and Barriers, etc.

Introduction

Scientific Innovations have changed the utilitarian view of information and communication technology systems in the glove. Modern system of information and communication technology (ICT) provides a dynamic and attractive teaching-learning environment of science. Scientific innovations offer many tools for teaching-learning science that are beneficial for the learners' deeper learning of scientific concepts. ICT integration in science education as the process of determining how technology fits in the facilitating and learning scenario. It is enabling everyone at any time anywhere to learn the scientific facts, knowledge, ideas, and practicum from the internet application. Huge research points out the applicability of ICT and they talk about how ICT can make a leading role for improving learners' science learning.

Teachers' needs to drill on ICT based practices for improving their science related ICT integrated pedagogical practices. Scientific innovations and integration of ICT are preparing and promoting the face of future challenges based on scientific understanding. Scientific innovations and researches believe that ICT use can help learners grow scientific competencies and fulfilling needs of the current and further globalization. It is because ICT integration with science can develop the learners' skills that boost their motivation for generating scientific ideas. Integration of communication technology (ICT) creates an information highway for the learners to establish scientific and critical thinking. This is to enable scientific creativity and competency for the present global scenario. Integration of ICT in science education will ensure that society needs and explores scientific innovation with the help of ICT, because ICT is highly regarded by global learners.

Integration of ICT in science education are beneficial for the various accepts of science pedagogy such as: Access, Aggregation, Manipulation, Rearrangement, and Repurpose of science knowledge (Bidarra, J., &Rusman, E. 2017). Integration of ICT produce self-learning management techniques in chronicperiod of COVID-19 spread. Where ICT makes significance role in mathematics teaching-learning process in different aspect of learning as accessibility, accountability and autonomy of learning in during choric period of COVID-19 spread. Students' are getting empathy, feedback, hope, joy, and sense-making guideline form their teachers' with keeping trust in during pandemic (Dadgar, M., & Joshi, K. D. 2018).

Objective

For constructing this paper authors develop the conceptual objective for developing this paper such as follows:

- To identify the applicability of integration of ICT in Science Education
- To identify the opportunities' of integration of ICT in Science Education
- To identify the basic efficiency/accountability of integration of ICT in Science Education
- To identify the barrier's in integration of ICT in Science Education

fulfilling the needs these objectives researcher search articles and papers with the help of Google scholar and open search on the Google, with the inputting those words such as: accessibility, applicability, opportunity and barrier's in integration of ICT in science education and deep

reviewing reference articles and papers for developing clear conceptual understanding about the integration of ICT in science education.

Basic Knowledge of Integration of ICT in Science Education

Basic Knowledge of Internet application which provides help in Integration of ICT in Science education.

- Knowledge of Internet application
- Knowledge of web conferencing tools like Zoom, Skype, Deco, Google meet, Microsoft meeting,etc.
- Knowledge of social networks such as Facebook, tweeter, what Sapp, YouTube, telegram, Instagram, etc.
- Capability of identification of icons and logos.
- Knowledge and applicability of operating systems and application software.

The applicability of integration of ICT in Science Education

The usability of ICT tools has been enhanced the interactive and produce the attractive solutions' of science (Kim, H. J., & Kim, H. 2017). And integration of ICT in science teaching enhance the learners engagement and collaboration environment in the classroom, promoting effective and attractive shearing and facilitating of scientific content, creating continuous feedback and assessment environment of science classroom, and creating professional and individual development environment (Valverde-Berrocoso, J., Garrido-Arroyo, M. D. C., Burgos-Videla, C., & Morales-Cevallos, M. B. 2020). There are some directly related factor related science learner as follows:

1. ICT Integration helpful in understanding Learners characteristics and learner abilities.
2. ICT Integration helpful in understanding Science teaching-learning process.
3. ICT Integration helpful in Planning and proceeding Science Curriculum at different stages of education (Primary, Secondary, higher Secondary, and University education).
4. ICT Integration makes a significant role in facilitating, elaborating, exposing and presenting online scientific content in online and offline form.
5. ICT Integration in Science for elaboration and exposition of scientific fact, theory, and ideas.
6. ICT Integration in instructional management as learning managements (LMS)
7. ICT Integration in facilitating Science Content
8. ICT Integration in carrying feedback and taking learner assessment
9. ICT Integration in analysis of science content

Some applicable Benefits of ICT Integration in Science Education

Emerging educational practices are beneficial for the academic enhancement such as: (1) e-learning is a powerful tool and learner should be adopt it in science learning (2) e-learning reduce the financial costs of the education (3) e-learning enrich the academic offer and large amount of information's related to science learning (4) e-learning produce the large range of

science based activities (5) e-learning developed the more competence in science education. And application ICT integration in science education produce large scale of benefits such as: (1) Integration of ICT in science education enhances the attractive and Innovative learning environments. (2) Integration of ICT makes more motivated and deepen conceptual understanding in science education. (3) Integration of ICT enabling a wider range of knowledge. (4)Integration of ICT enabling more opportunities of accessing scientific knowledge through web based technology. And internet application developing popularity in globe. (5)Integration of ICT nurturing the learners with capabilities of processing information about science education more efficiently. (6)Integration of ICT in science learning develops learners' attitudes with capabilities of science learning and possibilities.The modern era of science education changes rapidly with integrating ICT in science learning and its development. The integration of ICT in classroom context is getting meaningful helpful learners learning in science,and creating collaboration with science understanding(Ghavifekr, S., Razak, A. Z. A., Ghani, M. F. A., Ran, N. Y., Meixi, Y., &Tengyue, Z. 2014).And some applicable benefits of ICT integration in science teaching such as: (1) enhancing leaners' engagement and collaboration in the science classroom, (2) promoting effective shearing and facilitating scientific environment and content, (3) creating continuous feedback and questioning about the science, and(4) creating individual learner professional development ((Valverde-Berrocoso, J., Garrido-Arroyo, M. D. C., Burgos-Videla, C., & Morales-Cevallos, M. B. 2020).

The opportunities' of integration of ICT in Science Education

There are some ICT integrated opportunities to directly relate to science education which are increasing the learner achievement in science and engagement of learners in classroom(Valverde-Berrocoso, J., Garrido-Arroyo, M. D. C., Burgos-Videla, C., & Morales-Cevallos, M. B. 2020).such as follows:

1. Understanding of basic aspects of scientific approach.
2. The effectiveness of ICT application in facilitating and learning of science.
3. ICT can provide the help conceptualization of scientific concepts of science.
4. ICT provides help in drill skill of science.
5. ICT providing tutorial instruction of science.
6. ICT creates an integrated learning system with social sites such as Facebook,twitter, you tube, etc. and providing
7. ICT makes stimulations and motivation for the conceptualization of scientific concepts.
8. ICT Integration helps in controlling and monitoring in science experimentations.
9. ICT integration makes interactive multimedia fixture of science concepts.
10. Integration of ICT Science makes assessing and sharing information with the help of the internet.
11. ICT integration makes learning more effective.
12. ICT integration increases learner motivation and quality of content with respect to audio-visual effects. .
13. ICT integration enhances learners' sense of conceptualization of scientific concepts.

14. ICT integration in science provides learners' huge resources of learning.
15. Integration of ICT helpful in improving learners' achievement in science learning.
16. Integration of ICT gives autonomy for learners and creates an autonomous learning environment of science learning.
17. Integration of ICT helps in reducing the burden and pressure of conceptual difficulties in science. And its create the learning environment "joy" and "Happiness" which are beneficial for the sound learning according to Learning without Burden (Yaslpal,1993
18. Integration of ICT enhances learners' scientific, and logistic skills.
19. Integration of ICTcreating fresh look for science teaching-learning,and this helpful to reducing workload and mental pressure of learners as Teachers, Facilitators,Educators, and Students..
20. Integration of ICT helpful to reducing institutional and instructional burden and increasing quality instruction.
21. Integration of ICT helps increase the conceptualization processof science learning.

The basic efficiency/accountability of integration of ICT in Science Education

Integration of ICT in science teaching we need to increase the usability of science content and practicum (Valverde-Berrocoso, J., Garrido-Arroyo, M. D. C., Burgos-Videla, C., & Morales-Cevallos, M. B. (2020). Application of integration of ICT in Science education simulate, modulate, and Present scientific conceptual knowledge and issues with the help of technology.Component of ICT Integration of Science education which enables the effective efficacy for gaining scientific knowledge, such as follow:

- Vision of ICT integration of science
- ICT tools (Infrastructure such as hardware and software)
- Teachers/Facilitators and Teaching/Facilitating
- Learning Components of science (life science, social science, pure science, engineering science, geoscience, bio science, etc.)
- Scientific skill development
- Assessment and evaluation
- Organizational/ Institutional support

Barriers in Integration of ICT in Science Education

Science students were faced the lot of challenges related to information and communication technology(ICT) tools and resources' use, such as lack of ICT devices such as: computer, laptop, mobile, etc.), electricity and internet connectivity problem specially poor internet connectivity, expensive nature of internet subscription, and lack of necessary competency in related to use ICT devices(Bello, U. L., Hassan, L. A. E. A. E., Yunusa, U., Abdulrashid, I., Usman, R. H., &Nasidi, K. N. 2017). Some common barriers in our around us are most common but we are not enable to dispose it, the classification of barriers in integration of ICT in science education are classified in four areas such as: (1) human factors such as mindset and confidence of teachers, educators, and higher authorities (2) intrinsic value such as interest, believe, and

satisfactionfacts related to science teachers ((3) requirement of technological tools which are applicable to access and adoptable of science learning such as: hardware device and software applications. (4) Environment factors such as network connectivity and circumferences of scenario such as: institutional policies and political, institution economic policies and economic condition, teachers economic conditions, ideologies of teachers' and institution, cultural intention of institution, and psychological things and surroundings of institution (Mercader, C., &Gairín, J. 2020).

Mercader, C., &Gairín, J. 2020) are also focus on the typological barriers which are divided in four areas such as: personal, professional, institutional and contextual. Personal barriers which are related to characterizes bases of the many things such as:Teachers and educators attitude towards integration of ICT in science, technophobia in teachers mind, lack of interest and curiosity in ICT integration, and lack of confidence adopting ICT integration, life failures', and rejection of proposal work by senior authority. Profession barriers classified such as: (1) lack of training and training platform(2) lack of pedagogical existence of ICT integration in science (3) lack of practices and expiries of teaching with technology(4) knowledge of didactic use of technological tools(Mercader, C., &Gairín, J. (2020). And other barriers' in related to integration of ICT in science education author described such as follows:

- Lack of facilitating and educating, competency of science
- Lack of ICT tools handling competency such as computer competency,
- lack of competency in concerning ICT
- Lack of experience facilitating with scientific knowledge with the help of ICT
- Lack of Social and elaboration behavior with facilitating science.
- Lack of inconvenience rescores of integration of science education.
- Lack of ICT knowledge and Integration of ICT in science education.
- Facilitators and educators behaviors'with respect to integration of science education.
- Economical expenditure of organization/institution with refresh to integration of science education.
- Motivational level of the organization with respect to integration of science education.
- Learners'awareness and attitudes towards the integration of science education.
- Traditional approaches of learning developing barriers as adaptation of learning and integration of science.
- Poor motivation from family member and family members and faculty members(Bello, U. L., Hassan, L. A. E. A. E., Yunusa, U., Abdulrashid, I., Usman, R. H., &Nasidi, K. N. 2017).

Integration of ICT in science education are plays a significant role in facilitating and educating science learning. Integration of ICT in facilitating and educating practices is complex and challenging issue in science education. TPACK Model also focuses on the five-stage developmental process of integration of technology in facilitating and learning science(niess,sadri,and lee 2007). Such as:(1) Recognizing scientific knowledge, which are enable through the technology with the help of facilitators provide the enabling link of ICT integrated science content. (2) Accepting (Persuasion of Science), by which facilitators'favorable and unfavorable attitude towards facilitating and learning science content with appropriate technology. (3)Adapting (Scientific decision), by which facilitators engage in scientific activities

that lead to a choice to adopt or reject facilitating and learning specific science content with appropriate technology (4) Exploring (in the sense of implementation of Science), by which facilitating facilitators actively integrate facilitating and learning of scientific content with appropriate technology. (5) Advancing (Confirmation of scientific knowledge), by which facilitators redesign the curriculum and evaluate the results of the decision to integrate facilitating and learning science with technology. Intel and Microsoft also supporting the integration of ICT in science education and give their contribution reducing the barriers' and obstacles' in integration of ICT in science and other education.

Integration of ICT in Science Classroom

Today we observe that 'the scenario of the science classrooms or general classrooms are changing. Modern classrooms are replace the Black Board, White Board, and Marker Board and placed the Digital Board and Smart Board in the classroom(Bidarra, J., &Rusman, E. (2017). If teachers are competence with handling the Smart and Digital Board with producing the content (scientific, theoretical,descriptive, conceptual and empirical, etc.). If they find the difficulties in their mind in mid between the classroom to elaborate the scientific content and other content with the help of technological tools(Ghavifekr, S., &Rosdy, W. A. W. (2015).There had opportunities to get verify at the movement by the help of ICT. We are all aware about the present 21st century education system based on the learner centric, and learners had multiple sources of science learning to update their learning with the help of Information Communication and Technology.

Conclusion

Today ICT is not only scientific, technological discipline, they also make space and important in other disciplines of education. Today ICT application and association with social, economics, linguistic and cultural area. Integration of ICT in science education are beneficial for the various accepts of science pedagogy such as: Access, Aggregation, Manipulation, Rearrangement, and Repurpose of science knowledge. Today IT is not only discipline of science and technology it is discipline of shearing, transforming and transmission of information, and its application and ICT associated with social, economic, and cultural matter of information. ICT makes an important role in facilitating scientific content in world-wide view. Learners access the information and knowledge through television, digital media, cable network, internet, and social media i.e. Facebook, twitter,whatsapp, etc. A competent facilitator has several skills and techniques for providing facilitate successful science learning, so today required more competencies with knowledge of ICT and Science & Technology, to integrate with each other. At the present age of modernization of science and technology change the demand and need of the society. Without proper knowledge of ICT teachers', educators', and facilitators' cannot elaborate and transform scientific knowledge in the glove.

Reference

Niess, M. L., Sadri, P., & Lee, K. (2007, April). Dynamic spreadsheets as learning technology tools: Developing teachers' technology pedagogical content knowledge (TPCK). meeting of the American Educational Research Association Annual Conference, Chicago, IL.

Ghavifekr, S., &Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science*, *1*(2), 175-191.https://eric.ed.gov/?id=EJ1105224

Ghavifekr, S., Razak, A. Z. A., Ghani, M. F. A., Ran, N. Y., Meixi, Y., &Tengyue, Z. (2014). ICT integration in education: Incorporation for teaching & learning improvement. *Malaysian Online Journal of Educational Technology*, *2*(2), 24-45.https://eric.ed.gov/?id=EJ1086419

Bhattacharjee, B., & Deb, K. (2016). Role of ICT in 21st century's teacher education. *International Journal of Education and Information Studies*, *6*(1), 1-6.http://www.ripublication.com/ijeis16/ijeisv6n1_01.pdf

Payal, H., &Vinod, K. K. (2018). Learning with ICT: Use & barriers from teachers' perceptions. *International Journal of Recent Science Researches*, *9*(1), 23545-23548.

Dhital, H. (2018). Opportunities and challenges to use ICT in government school education of Nepal. *International Journal of Innovative Research in Computer and Communication Engineering*, *6*(4), 3215-3220.https://d1wqtxts1xzle7.cloudfront.net/56438994/

Bello, U. L., Hassan, L. A. E. A. E., Yunusa, U., Abdulrashid, I., Usman, R. H., &Nasidi, K. N. (2017). Challenges of information and communication technology utilization among undergraduate community health nursing students in Tanta University, Egypt. *American Journal of Nursing*, *6*(3), 274-279. doi: 10.11648/j.ajns.20170603.26

Kim, H. J., & Kim, H. (2017). Investigating teachers' pedagogical experiences with tablet integration in Korean rural schools. *The Asia-Pacific Education Researcher*, *26*(1-2), 107-116.

https://link.springer.com/content/pdf/10.1007/s40299-017-0331-8.pdf

Bidarra, J., &Rusman, E. (2017). Towards a pedagogical model for science education: bridging educational contexts through a blended learning approach. *Open Learning: the journal of open, distance and e-learning*, *32*(1), 6-20.https://doi.org/10.1080/02680513.2016.1265442.

Valverde-Berrocoso, J., Garrido-Arroyo, M. D. C., Burgos-Videla, C., & Morales-Cevallos, M. B. (2020). Trends in educational research about e-learning: A systematic literature review (2009–2018). *Sustainability*, *12*(12), 5153. https://doi.org/10.3390/su12125153

Dadgar, M., & Joshi, K. D. (2018). The role of information and communication technology in self-management of chronic diseases: an empirical investigation through value sensitive design. *Journal of the Association for Information Systems*, *19*(2), 2.https://aisel.aisnet.org/jais/vol19/iss2/2/

Mercader, C., &Gairín, J. (2020). University teachers' perception of barriers to the use of digital technologies: the importance of the academic discipline. *International Journal of Educational Technology in Higher Education*, *17*(1), 1-14. https://doi.org/10.1186/s41239-020-0182-x