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A REVIEW OF LITERATURE ON RESEARCH IN SCIENCE EDUCATION IN INDIA

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ABSTRACT

Research in Science education helps in identifying the current knowledge and trends of how teaching and learning in science is taking place at all school levels. It also helps in improving instructional practice in schools and teacher education. This paper present the literature review of journal published in the Journal of India Education, Indian Educational Review, Indian Journal of Educational Technology & Voices of Teachers and Teacher Educators. It highlight the low trend in research in science education so an effective planning is requires to boost science education.

Keywords: Science Education, Review, Science Education Research

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1. INTRODUCTION

Development in science and technology is considered to be the most important key to boost the economic and social growth of a country. Encouraging a good science education at all levels of education is proven to be a good foundational pillar for the development of a country. Science Education as explained by Carter (2011) is a field of study which is vast, varied, and ambiguous. It have its own area of interest like classroom teaching and learning, curriculum, teacher education, measurement and evaluation, factors relating to students, policy development and implementation, philosophy, socio-cultural nature of science and so on. Science education is also considered as an interdisciplinary field where science is the major reference and competencies in other disciplines are also required. In order to check the worthiness of teaching a topic, an understanding of pedagogy and psychology is needed. To understand the nature of science philosophy and history helps in thinking about the pattern critically. So such an interdisciplinary nature of science is responsible for specific challenges in research and development in science education Duit (2006). The aims of science education are arousing curiosity and excitement in the learners about the event and phenomenon around them. The NCERT position paper on science teaching stated that: *"good science education is one that is true to the child, true to life and true to science".*

1.1 Trends in Science education Research globally

Lin T J Etal had been doing a review of research in science education for every five years since 1998. Their review is based on three journals Science Education, Journal of Research in Science Teaching, and International Journal of Science Education. Their focus is on finding the country which contributed the most, variation in type and topic of the published articles over a period of time, highly cited article etc, . The research topic was categorised into nine areas (1) Teacher Education (2) Teaching (3) Students' conceptions and conceptual change (4) Classroom Contexts and Learner Characteristics (5) Goals and Policy, Curriculum, Evaluation, and Assessment; (6) Culture, Social, and Gender issues; (7) History, Philosophy, Epistemology, and Nature of Science; (8) Educational Technology; and (9) Informal Learning which was an adaptation from National Association for the Research in Science Teaching (NARST) conference research strands. Based on their review published in 2019, it is found that from 2013 to 2017 the top ten countries in the rank of publication in science education in descending order are US, UK, Germany, Taiwan, Australia, Sweden, Canada, Israel, Netherlands and Spain. It was also found that 36.7 % of studies were done of the topic related to learning context showing that researchers have interest in exploring issues related to learners' characteristics and classroom context. It is followed by topic related to teaching which is about 17.7% of the study conducted followed by learning-conceptions which is 10.2%.

1.2 Report on research in Science Education in the Sixth survey of educational research (1993-2000)

The Sixth survey of educational research (1993-2000) reported 120 researches in science education which were from Indian Educational Abstract, International Journal of Science Education, Resonance, Journal of Research in Science Teaching and the Journal of Education and Social Change. Even though the number of research appears low as compared with the number of growth in school, college, universities it was categorised as given in the below table 1.

Table1: Categorisation of studies in Science Education

Area	No. of Studies	percentage
Students' attitude towards science	13	11
Cognitive studies of science	39	32
Teaching Material	18	15
Science Teaching	23	19
Environment factors	7	6
Achievement of students in science subjects	6	5
Creativity	3	3
Gender issues in science teaching	6	5
Miscellaneous	5	4
Total	120	100

Source Sixth Survey of Educational Research

It is also important to note that total of 101 studies were done during the first four surveys from 1974 to 1988 and 61 studies were included in fifth survey from 1988 to 1992.

1.3 Need for review in research in Science Education

A systematic and periodical analysis of the trend in the current research in science education will helps to gets an insight on currents issues and problems related to classroom teaching to new researcher, teacher educator, science teachers and policy makers. Lin T J Etal (2019) stated that through critical examination of research publication in important journal helps researcher to have a distinct views of the past, present and future practices in a field of study. The NCERT position paper on science teaching mentioned that we are still away from the targeted goal as enshrined in our constitution regarding science education. As the current form of teaching develop only competency in science but not creativity and innovation. So a paradigm shift in science education is required for India. The existing condition in science education and research in India is not good Desiraju (2008). Therefore, a systematic and periodical scrutiny of the current status of science education research is certainly needed to facilitate the advancement of science teaching and learning practices through research.

1.4 Objective

To give an overview on research publication in science education from 2010 – 2020 in Journal of Indian Education, Indian Educational Review, Voices of Teachers and Teacher Educators and Indian Journal of Educational Technology

2. METHOD

This study analysed journal publication related to science education in the four journals i.e Journal of Indian Education, Indian Educational Review, Voices of Teachers and Teacher Educators and Indian Journal of Educational Technology from 2010 – 2020. The researcher follows the categorisation given in the Sixth Survey of Indian Educational Research with some modification by taking into consideration similar studies done in the Science Education.

3. REVIEWS OF RESEARCH IN SCIENCE EDUCATION:

In the present study the researcher could identify 72 studies related to science Education from the year 2010 to 2020 in the Journal of Indian Education, Indian Educational Review, Indian Journal of Educational Technology and Voices of Teachers and Teacher Educators. The studies were categorised into 12 (twelve) areas of research studies (1) Policy, Curriculum, syllabus, textbook (2) Students' conception and Learning of science (3)Teacher Education (4) Nature of Science (5) Achievement in Science (6) Outcome of Science Education: Scientific temper, attitudes (7) Gender Issues (8) Assessment and Evaluation (9) Environmental studies (10) Integration of technology and ICT (11) Science Teaching (12) Miscellaneous. The identification of the category was done by studying the areas of categorisation in the fifth survey and sixth survey with some modifications. The table 1 indicate categorisation with the number of studies conducted.

Table 2: categorisation of research studies in science education

Area of Science Education	No. of Studies	In Per cent (%)
Policy, Curriculum, syllabus, textbook	8	11.1
Students' conception and Learning of science	6	8.3
Teacher Education	4	5.5
Nature of Science	6	8.3
Achievement in Science	7	9.7
Outcome of Science Education: Scientific temper, attitudes	1	1.3
Gender Issues	2	2.7
Assessment and Evaluation	2	2.7
Environmental studies	11	15.3
Integration of technology and ICT	2	2.7
Science Teaching	16	22.2
Miscellaneous	7	9.7
Total	72	

3.1 Science Teaching

Majority of the studies was found in science teaching with 22.2 % during 2010 to 2020. This area was the second largest focus area in the 6th survey. Gupta A (2010) in 'Science Through Activities' explained that science is best learnt when it goes beyond the classroom and when it also addresses the problems of the community at large. Such teaching makes science alive and vibrant. The study also mentioned of using local materials for making simple science models. It helps children in learning science better. In another paper in science teaching Dogra B(2010) in 'Constructivist Classroom Activities for Biology Learning' discussed about classroom activities that helps in encourage thinking, understanding, exploration, problem solving, collaboration, analysis, observation and prediction in learning Biology. Parashar R and Singh V (2011) show the situation of classroom practices of Science at upper primary level in the eastern region of our country. The study emphasize that classrooms are to be equipped to used ICT and it should also be used to evaluate the students as well as to find students with learning problems. The study also focuses on giving students chances to explore the use of internet and communication technology in the process of learning Science. Concepts in science should be explained by involving them in activities. The teacher should also be ready to change their instructional strategies to meet students' individual needs and requirements. Das B (2012) in a quasi-experimental study, the traditional method adopted for teaching general science to Class IX students was compared with teaching through self-study material (SSM) for teaching general science to same students to test the effectiveness of the SSM developed. It was found that teaching with SSM is better than the traditional method for teaching General Science to Class IX students. Jain A and Bhardwaj S

(2012) concluded that the use of 5E Instructional model bring coherence to different teaching strategies and provide connections among educational activities. It also helps the science teachers in make decisions about how to interact with students. The study also emphasize on the need to introduce this model and other constructivist method in teacher education curriculum. In another similar study on the effect of 5E model of teaching Mohalik R and Behera S (2018) found improvement in higher order thinking skills of the students. Sharma K (2013) found that concept mapping strategy more effective than the traditional method in teaching organic chemistry. It helps in concept retention, achievement and also improves retention. In another study on effectiveness of Inquiry Training Model (ITM), Dwivedi R (2014) found that using of ITM method was more than the conventional method. Parida B and Mohapatra J (2015) in study related to language of science and teaching learning of science emphasize that language is important for knowledge construction and sharing so language deficiency will inhibit academic growth of an individual including the career. Thomas M and Kothari R (2017) focus on the development of collaborative skills through cooperative learning (CL). Thakur K and Thakur K (2020) compared the effect of two cooperative learning techniques (JIGSAW IV and STAD) on science self-efficacy. It was found that JIGSAW IV yielded better science self-efficacy scores. Shivani (2020) in a study related to impact of experiential learning found that experiential learning model is more effective for enhancing self-efficacy of students in the teaching of science subject.

3.2 Environmental studies

The second highest was found in studies related to environmental studies. Vellaisamy M (2010) study the correlation between the achievement of the students in environmental education and awareness but no significant positive relationship was found between them. Mehra V and Kaur J (2010) also study the effect of experiential learning strategy and traditional learning method on enhancement of environmental awareness. Sudhir M (2013) mentioned that participatory learning and action will help students understand the environmental issues. Dogra B (2013) studied on the challenges and issues faced by the EVS teachers at primary stages and helps in making simple strategies to change these challenges into opportunities. Sharma K (2018) highlights the gaps in environmental education research and provides suggestions for future research. Shair B and Akhter R (2012) found that the overall awareness and implementation of environmental knowledge in adolescents is far below the expectations. Sharma K and Devi L (2012) highlight the importance of integrated learning in EVS. Sampath K and Sundaramoorthy T (2014) studied the knowledge of environmental concern of elementary teachers and environmental concerns of students. Aneeshya P (2018) conducted a study to find the perception of higher secondary school teachers on impact of anthropogenic global warming on environment among 390 teachers of various schools of Kannur, Thrissur and Trivandrum districts and the study reveal that teachers have an average perception about the impact of anthropogenic global warming on environment.

3.3 Policy, Curriculum, syllabus, textbook

The third highest paper was found in textbook analysis and curriculum. Singh S and Singh S (2019) studied the nature and effectiveness of the activities, given in NCERT's 9th grade science textbooks and found that activities contain basic science process skills in a representative way. Saxena A and Behari A (2019) analysed the class 12 Biology textbook with respect to the inclusion of ethical issues. Bansal G (2014) analysed the middle grades science textbooks for their potential to promote scientific inquiry. Mohanty G (2012) did a critical study of secondary school science curriculum and four more studies were found related to studies on textbook and curricular documents. Kaur G and Sharma K (2017) studied the curricular objectives of EVS and role of teachers in mediating link between the intended and the transacted curriculum. The study mentioned that textbooks have social and scientific understandings in specific contexts which would otherwise appear to be meaningless with bearing on our real lives. Singh S (2011) critically appraised the General Science content of Class VII textbooks prescribed by Rajasthan Board of Education for its relevance and adequacy. It was found that the contents were environment oriented making the learner aware and understand the environment. Khan A (2018) conduct a review study of different curricular documents which were developed post-independence that show the role of Science as a subject in general. Mukherjee A (2017) reflect on how science which was once regarded as challenging is now considered uninteresting by school students. It also argued that such thing happen because of the way science is taught in schools.

3.4 Achievement in Science

The fourth highest study was found in achievement in science. Sharma K (2014) studied the effectiveness of concept mapping strategy on student's achievement and found that experimental group was able to attain significantly higher

achievement scores. Kumar N and Kumar R (2011) studied achievement among male and female science students in relation to psychological stress. The findings showed that both male and female science students significantly differed on psychological stress and achievement. Two more studies with the psychological issues were also found. Banerjee S, Das N and Mohanty A (2014) studied the impact of teacher competence and teaching effectiveness on students' achievement it was found that students differ significantly in achievement subject due to teaching by high or low competent teachers and also due to high or low teachers' teaching effectiveness. Another study on effectiveness of smart class on achievement and personality as predictors of student's achievement were also done. Misra K and Srivastava S (2016) explored science achievement in relation to personality by selecting 579 ninth grade students (289 boys and 290 girls) of Allahabad city, the finding shows that science achievement is positively related to nine personality traits i.e - self-sufficient, sociable, analytical, independent, perseverant, inquisitive, motivated, divergent and adaptable and negatively related to five personality traits-crooked, alienated, group-dependent, rest-loving and pessimist

3.5 Students' conception and Learning of science

The researcher is able to find six (6) papers in this area. Rajan K (2011) study find some light on the phenomenological primitives on 11-year old students on the concepts related to light, electricity, mass, weight and solutions by developing a 10-item two-tier multiple choice test. It was administered to 414 sixth grade students of twelve schools which include government, aided and unaided schools located in rural and urban areas. The results indicated that sampled students hold that energy is associated with moving objects only. Shome S & Natarajan C (2012) developed a short course on energy and environment to engaged students of Class VIII in large variety of activities which were designed to explore their understanding of energy and its flow through life forms emphasizing on the link between humans, energy and the environment. Sharma P (2016) presented a critical analysis of teaching-learning practices followed in the classrooms and also evaluates the potential of these practices in fostering thinking abilities among the students. Krishnan D (2017) tried to identify alternative conceptions in Physics among the secondary school students of D.M. School of Regional Institute of Education (RIE), Bhubaneswar, Odisha. In the study 9th standard students of D.M. School were taken as the sample and a two-tier concept attainment test with a semi-structured interview were used to collect the data in the themes related to motion, force, sound, light and electricity. The study suggested that a well-constructed system of pedagogical design is required to be integrated in the teaching-learning process so as to redirect alternative conceptions in Physics to conceptual change among learners. Mohapatra A & Roy A(2018) had explored how the secondary students used drawing to communicate their understanding of the human digestive system for that six schools in Bhubaneswar — three affiliated to the CBSE, two to the Odisha State Board and one to the West Bengal State Board, were selected and 478 students of Class X of these schools were used for the particular study. They found that the drawing skills of maximum of students were poor and were not monitored by the teacher for assessment in their understanding on the human digestive system. They also found several misconceptions among the students which are related to the position, shape, size and colour of various digestive organs. Dhar D & Gowramma I P (2017) did an investigation and also analyse the strengths and weaknesses of students in drawing and labelling skills on class VII students. The result indicates that majority of the students lacked drawing and labelling skills. This lack of skill creates doubt on their understanding of biological concepts and also on their overall performance in the subject.

4. CONCLUSION

This paper has sought to provide a review of the researches related to science education. It was found that very less studies on science education were found in the four journal i.e Journal of India Education, Indian Educational Review, Indian Journal of Educational Technology & Voices of Teachers besides the above broad themes few studies on Nature of Science, Teacher Education, Gender Issues, Integration of technology and ICT, Assessment and Evaluation, Outcome of Science Education: Scientific temper, attitudes were also found. Therefore it can be concluded that only a handful of research related to science education were studied over the 10 years. Given the paucity of research in these areas it is recommended that more studies related to science education should be done by teacher educators at various institutions and teachers teaching science at various levels in school to highlight the problems, innovative teaching method and other related theme in teaching science.

CONFLICTS OF INTEREST

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