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RESEARCH ARTICLE

RESEARCH TRENDS IN SCIENCE EDUCATION.

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Abstract

There have been several paradigm shifts in the literature of research in the area of science education. To feed the knowledge pool in the area of science consistently, there is a need to remain updated and abreast of the ongoing trends in research globally and also nationally. This task also takes us in the journey of historical accounts and upheavals that all surrounded the progress of research in science education. It also helps us to situate our studies in the knowledge pool of findings and scope of further research. This summary of researches done so far and analytical framing of them in an emerging pattern also gives us awareness and confidence of the utility of our research. In the age when growth and development of the nation relies on the firmness of science education, it becomes important to carry out further the investigations, inquiry and research in science education as per the needs which surround the quest. This paper is an attempt to take out the emerging picture of types of researches so far have been put in practice and how they have kept changing with times.

Introduction:-

This paper talks about the research trends in science education research in the past four decades (1974-2015). In the last 40 years, there has been a huge increase in international professional research activities, resulting in an increased output of publications in science education research from a wider range of nations, and an increased amount of professional development initiatives.

At the classroom level throughout the past 40 years, there has been a constant call for more relevant science education and for greater inclusivity in science education (as is illustrated by the need for science curricula that do not simply reflect social and cultural stereotypes of science). During this period, there has developed a great diversity of the types of research being conducted in science education. At one end of this spectrum are large-scale assessment programs (as is illustrated by the Trends in Mathematics and Science Studies (TIMSS) and the Program for International Student Assessment (PISA) studies which provide both national data and international comparisons). At the other end of this spectrum are small-scale studies of the work of science teachers in individual classrooms (as is illustrated by action research studies and the detailed documentation of expert practices). To be able to conduct studies of this range, over the past three decades, there has been an increasing acceptance of alternative genres of science education research and an acknowledgment of their own strengths and weaknesses.

Usually research is accompanied by the need of the time. **2003–2007**, **context of students'** learning replaced **students' conceptual learning**, which was the most published research topics from **1998 to 2002**. The research

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topic of **students' learning contexts** continued to rank the first in **2008–2012**. Moreover, there was an **increasing trend of research papers regarding science teaching** from **1998 to 2012**. The analysis of highly cited papers revealed that research topics such as argumentation, inquiry-based learning, and scientific modeling were recently highlighted by science educators. In recent 15 years, producing researchers' publications also focused on the topics about the context of students' learning, science teaching, and students' conceptual learning.

In this review of developments in science education research over the past four decades (1974-2015), we will refer to the following aspects: The four aspects that have defined science education research over the past 40 years could be-

1. The huge increase in international professional research activities,
2. A constant call for more relevant science education,
3. An increase in the diversity of the types of research being conducted in science education and
4. A need for a greater understanding of the relationships between policy and practice and a realistic expectation of what science education research can contribute to practice.

There has been great interest in providing a relevant science education for school-aged youth as is illustrated by a growing interest in appropriate curricula offerings in science for post compulsory schooling and different forms of assessment in science. The major concern has been the achievement of scientific literacy

The recognition of culture outside influences on the science curriculum can come from persons within the culture. However, the notion of culture and what this term means in the context of classroom teaching and learning and how a better understanding of this phenomenon can move science education research forward is an area needing further research. Indeed, the initial research on cultures was not conducted by science educators; rather science educators have become aware of this research and are using it to interpret life in schools and classrooms and thereby gain a better understanding of activities engaged in by teachers and students (Cobern, 1998).

Concerns in post-compulsory schooling and inclusivity in most nations, there are increasing numbers of students staying on beyond compulsory leaving age (typically 15-16 years old) and over the past two decades at least there have been consistent calls for a curriculum to meet their particular needs. Consequently, there is a growing interest in post compulsory schooling and what this means for an appropriate curriculum in science education. Linked with this concern is an interest in scientific literacy and assessment at all levels of formal schooling and beyond.

Diversity in research in science education research is not conducted within one paradigm because there are too many fundamental differences about the nature of science education. Indeed, science education is not quite a research paradigm, there is too much disagreement at a fundamental level. Nevertheless, science education research is characterized by the issues it addresses and these include **Learning, Teaching, Educational Technology**, **Curriculum**, **Learning Environments, Teacher Education, Assessment and Evaluation, Equity, History and Philosophy of Science.** Research methods in science education draw on perspectives from philosophy, psychology, sociology, as well as history, anthropology and economics. During the past 40 years, there has developed a great diversity of the types of research being conducted in science education and there is a growing acceptance of these different research genres, often borrowed from other disciplines.

Research on the **impact of technology on teaching** is of key importance as is illustrated by the review by Linn (2003) which looked at this impact in terms of science texts and lectures, science discussions and collaboration, data collection and representation, science visualization and science simulation and modeling. As the review showed, there is an increasing use of computers in schools but more research is still needed to investigate how students learn science with computers? Similarly, there is an increasing use of on-line resources, but how beneficial are these to learning science and is it better to learn science in a synchronous and asynchronous manner with on-line resources? Related to this issue are the problems faced by teachers when using computers in their teaching. Some schools require students to have laptop computers and research is needed to demonstrate whether or not this is the way to improve/enhance learning.

Concerns about **scientific literacy Science education** reforms in a number of countries (for example, Australia, New Zealand, England, and the USA) promote a standards-based definition of scientific literacy for all people such that they can understand science and apply the big ideas to real problems and **issues involving science, technology, society and environment** (Hand, Prain and Yore, 2001). At the same time, researchers are examining **the specific**

roles ofreading and writing in science education (Yore, Bisanz and Hand, 2003). The Program for International Student Assessment (PISA) conducted by the Organization for Economic Co-operation and Development (OECD) has a different approach to the Trends in International Mathematics and Science Study (TIMSS). PISA is aimed at reading, science and mathematical literacy and the testing are in terms of mastery of skills deemed essential for daily life. The results from TIMSS and PISA studies have provided a very strong incentive for each nation's government to look at the status of science education. Indeed, many of the countries that performed less than anticipated on these assessment measures have obtained government funding to help address the perceived weaknesses in science education. In almost every nation, there is a desire to ensure high levels of scientific literacy among school-aged youth and TIMSS data do not necessarily provide this evidence.

Research interests in science education are in the practice of teaching and learning, together with **assessment, evaluation and teacher education**; there is less on philosophical issues. A look at the research literature in science education would indicate that in the past three decades, the work was dominated by research concerned with the following topics. **Children's understanding and learning of scientific phenomena** (Miller, Leach and Osborne, 2000; Wandersee, Mintzes and Novak, 1994) · **Conceptual change research** (Duit and Treagust, 2003; Hewson, 1996) · **Constructivist views of learning/teaching** (Fensham, Gunstone and White, 1994) · **Nature of science** (McComas, 1998) · **Perception studies - classroom environment, attitude** (Fraser, 1994) · **Equity and gender issues in science** (Baker, 1998; Rennie, Parker and Fraser, 1996) · **Scientific literacy** (Yore, Bisanz and Hand, 2003) · **Assessment/Evaluation** (Tamir, 1998) · Science Teacher Education (Abell, 2000; Anderson and Mitchener, 1994) · **History and philosophy of science** (Duschl, 1994). **Science education, influencing policy and practice-** As a domain, science education research grows by its own activities and also by being open to outside influences.

Research Type:-

Research can be categorized into the following five categories on the basis of methodology:

1. **Empirical research** article, such as quantitative, qualitative, and mixed-
2. Method research;
3. **Position paper**, in which the researchers articulated a specific position for a certain issue of science education;
4. **Theoretical paper**, in which the researchers proposed a new theory or a theoretical framework in science education;
5. **Review paper**, in which the researchers summarized the science education literature without imposing a strong position;
6. **Others** (e.g. A description of a certain reform program of a specific country).

Research Topic:-

Major research trends in science education in the time period of 2011-15

Table:- Category table for research topics

S. No	The name of category	Category explanation
1	Cultural, Social and Gender Issues	Multicultural and bilingual issues; ethnic issues; gender issues; comparative studies; issues of diversity related to science teaching and learning.
2	Educational Technology	Computers; interactive multimedia; video; integration of technology into teaching; learning and assessment involving the use of technology
3	Goals and Policy, Curriculum, Evaluation, and Assessment	Curriculum development, change, implementation, dissemination and evaluation; social analysis of curriculum; alternative forms of assessment; teacher evaluation; educational measurement; identifying effective schools; curriculum policy and reform
4	History, Philosophy, Epistemology and Nature of Science.	Historical issues; philosophical issues; epistemological issues; ethical and moral issues; nature of science; research methods
5	Informal Learning	Science learning in informal contexts (e.g. museums, outdoor settings, etc.); public awareness of science
6	Learning — Classroom Contexts and Learner Characteristics (Leaning — Context)	Student motivation; learning environment; individual differences; reasoning; learning approaches; exceptionality; teacher–student interactions; peer interactions; laboratory environments; affective dimensions of science learning;

		cooperative learning; language, writing and discourse in learning; social, political, and economic factors.
7	Learning — Students' Conceptions and Conceptual Change (Learning — Conception)	Methods for investigating student understanding; students' alternative conceptions; instructional approaches for conceptual change; conceptual change in learners; conceptual development.
8	Teaching	Teacher cognition; pedagogical knowledge and pedagogical content knowledge; forms of knowledge representation (e.g. metaphors, images, etc.); leadership; induction; exemplary teachers; teacher thinking; teaching behaviors and strategies.
9	Teacher Education	Pre-service and continuing professional development of teachers; teacher education programs and policy; field experience; issues related to teacher education reform; teacher as researcher/action research.

Conclusions:-

The current exploratory and descriptive paper has thus put forth the historical account of the changes in trends of research in the area of science education. The trends from 70s upto 2015's talk about the prevailing paradigms of contextual studies being sociological in nature which gradually transformed into teacher education in current decades of post 2010's. There has been ranges of research trends viz- cultural and gender studies in science which was further taken up by educational technology, followed up by policy researches, then there came a tremendous phase of historical, philosophical, epistemological and nature of science related researches in 80s in India. Recently there have been increase in the researches in science, particulary in an informal science area followed by learners context based study and very recently teacher education. Science is tentative as the ways of finding knowledge in science also keep on being modified, transformed and newly created i.e. tentative in nature.

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