Gender Equality In School Curriculum: Implications For Teaching And Classroom Interaction At Senior Secondary Level For Science Students

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Abstract

This paper discusses the content and delivery of education and how it can reflect and reproduce gender inequalities. Girls' and boys' learning and interaction with each other, and the teacher, are influenced by ways of teaching, the content of the curriculum, and relations within the classroom. The paper highlights these aspects of educational provision-curriculum, teaching and learning, and the dynamics of the classroom and school. It further discusses a gender-equitable approach to schooling, making teaching and the curriculum gender equitable in schools and ways of educating teachers to promote gender equality in schools. The paper recommends changes needed to ensure that educational provision will promote gender equality in schools in the new millennium." The purpose of this study is to investigate the experiences of female students in science classes and to answer the issue of how females become involved in the scientific community. But being out in the field also brought the very necessary need to situate scientific education within the broader sociopolitical and economic framework. Many socioeconomic factors, in addition to pedagogy and families, contribute to the construction of ideas about science, education, and ambitions. It seems that learning experiences and job choices are shaped by a complex web of elements, including family, class, gender, parents' occupations, urban lifestyles, schools, pedagogy, curriculum, social and economic status. Attempting to connect classrooms, textbooks, and broader concerns that impact learning experiences is the goal of the current research.   This research is purely exploratory. Using a qualitative ethnographic method allowed us to go deeper and evaluate the aspects that affect the experiences of the girls in this research, which aimed to understand their school background and the learning possibilities available to them. The methodology used to study science in a classroom setting is highlighted in this paper. Gendered narratives may be traced in the context of learning by looking at the nature of science, using a feminist perspective, and drawing on Walkerdine's research on mathematics learning.

Keywords: Gender Equality, Curriculum, Classroom interaction, science curriculum.

Introduction

The question of gender and science has different dimensions. One is the issue of gender in science which is related to access and participation in science; the other dimension relates to the role of science in the production of knowledge that might be gendered or biased. There are gendered notions about men and women and their ability. Science is considered as a male domain as it is objective and involves reason (Keller,1985). Such gendered capabilities in science are constructed in textbooks and classrooms and by families, media and society which affects the participation of both men and women in science. A significant issue is how sciences and biology, in particular, have been used to construct gendered and deterministic notions of human beings and society (Rose,1994). Experiments and research in areas like neurosciences, biological reproduction and behaviour have tried to prove and explain 'natural' differential capabilities of men and women, as well as other societal inequalities. A large body of literature has attempted to unpack the epistemological, methodological and most importantly ideological bases of this research. There has been research uncovering the various dimensions of gender and science. Research in education has looked at disparities in terms of enrolment and retention with respect to caste, class and gender and the reasons for inclusion and exclusion of underprivileged groups. In the context of ensuring enrolment and completion of schooling, there is some policy attention in recent decades to address gender disparity in primary and secondary education. However, data for 2015-16 indicate close to 19% drop out 1 of girls by the time they reach Class 10. Among the Scheduled Tribes (ST) the drop out is recorded as high as 24%. The reasons are well documented and usually depend on the economic and social status of the family, availability of school in the neighbourhood, the presence of female teachers, availability of toilets in the school and many such factors. According to Khan (2001), the access and quality of education women receive is poor and are the most disadvantaged in this regard and more so if they belong to disadvantaged caste and class groups as the drop-out rates indicate. Classroom-based studies that analyse the micro-contexts, teacher's knowledge and identity, curriculum and pedagogy of school subjects through the sociological lens are few and emerging in the Indian context.

Research in the field of science education has garnered significant attention from educationists for a number of reasons. A number of research have investigated different methods of teaching and studying science in an effort to deduce its meaning and purpose. International studies on STEM (science, technology, engineering, and mathematics) education have provided crucial evidence for shaping national strategies and curricula. Research in India, like that of Rampal (1992), has examined public perceptions of scientists and scientific knowledge. An innovative scientific education initiative in Madhya Pradesh, the Hoshangabad scientific Teaching initiative (HSTP) investigated several methods of teaching science in schools from 1972 to 2002. How science connects to students' individual learning styles and social environments is something that Sharma (2007) has investigated. In India, the sociology of scientific education is quickly becoming a prominent field of study.

Concerned about the gender gap in science, researchers have focused on women's participation in the field and how to increase their access to scientific courses in higher education. Women are more likely to pursue fields in the social sciences, literature, and biology as opposed to the hard sciences, mathematics, and engineering, according to data from across countries (Brotman and Moore, 2008). In India, there is a similar disparity (Chanana, 2007). Caste, class, family, and gender connect with enrollment in higher education in several studies (Mukhopadhyay and Seymour, 1994; Chopra, 2005; Chanana, 2007). Findings from this research have shown ways to increase student engagement in science, particularly among female students.

Classroom experience in school to an extent determines what students choose to study later. Girls' experiences and learning opportunities and later career choices are shaped by various factors- teachers' pedagogy, interactions among students and peers, school environment, curriculum and textbooks, the society, girls' interest and perceptions, family status in terms of class and caste and cultural and economic factors. These factors intersect with family choices and aspirations regarding girls' education. Career choices are made and identities start forming at the adolescence (Barton, Tan and Rivet, 2008). Thus, locating the study in high school is important to understand the experiences and factors that shape these subject preferences and career choices.

Objectives of the study

- To know the policies and practices of Gender Equality
- To know the importance and implication of Gender Equality in course Curriculum
- To know about the importance and application Classroom interaction of secondary school

Methodology of the study

This study is completely based on secondary data in nature. The secondary data have been collected form, books, journals, periodicals, magazines, research papers and government proceedings related to Gender Equality, course Curriculum and Classroom interaction of secondary school. This research covers reviews, discussion, models and application on Gender Equality, course Curriculum and Classroom interaction for the secondary school. Narrative technique has been used for findings and discussion.

Science curriculum

Globally, the current discourse around 'scientific literacy for all' is based on the belief that scientifically literate persons would be able to ask questions, describe and explain natural phenomena, read and understand scientific information, use the knowledge for decision-making and be aware of issues informed by science (Hodson, 2003). The objectives of science teaching have changed and evolved over the years, undoubtedly informed by political and economic factors. Science teaching is complicated as the aims are many and some are ambiguous. 'One of the challenges in science teaching is to ensure that most appropriate aims are met for all students' (Woolnough, 1994, p. 11). The curricular aims and policies on the teaching of science in schools in the post-independence Indian context are traced below to understand the discourse in science education.

Policies and curricular aims of teaching science. The policy reports and curricular documents since Independence are considered here.

a) Report of the Secondary Education Commission, 1952-1953 (also known as Mudaliar Commission): The report mentions that science can be treated as 'general science' in the middle school and specificity can start at the level of high school. It recognises that the curriculum should be such that it prepares those who might specialise in science and at the same time provide an understanding of fundamental principles to those who may not become scientists. It notes, 'Its aim is to give basic understanding and appreciation of scientific

phenomenabiological and physical--which may prepare the "non-scientists" for a fuller and more complete life' (Mudaliar Commission Report, 1953, p.76). It locates science as part of 'liberal' education and aims to nurture the curiosity of students. It also mentions that 'human side' of science need to be introduced through the life histories of scientists.

b) The Indian Education Commission, 1964-1966 (also known as Kothari Commission): Science and technology were given greater attention in the decade of the 60s, as India embarked on a programme of heavy industrialization. Science was viewed as the key for economic and national development. Kumar (1996) refers to the Kothari Commission report and points out to the discourse of science being synonymous with modernisation in the report. The Nehruvian idea of 'scientific temper' is referenced throughout the Kothari Commission report in the context of science education. It recommends a disciplinary approach to science moving from general sciences recommended in the Mudaliar Commission. It also stresses on 'science as a discipline of the mind'."

The launch of Sputnik by the former Soviet Union and the Space Race between the Soviet Union and the United States started equating the nation's progress and growth to advancement in science and technology. This also led to blurring the line between science and technology. During the same time, it was felt that human advancement could be achieved only through science in India. Science was projected as a goal of the state and means to development (Nandy, 1988). 'Indians began to pursue science as a quest for a national scientific identity' (Banerjee, 1998, p. 1199). The education system and teaching of science adapted to this discourse, with school textbooks presenting the idea of modernity and development through the country's progress in science.

That economic development of the nation is related to advances in science and technology came to be fixed within the postcolonial imagination of development. The aims of science education came to be framed around this discourse. Although writers have referred to the multidimensional aims of science education (Driver et al., 1996) - economic, utilitarian, democratic, science learning, cultural and moral – the Kothari Commission report seemed to refer to economic and utilitarian purposes more than other purposes of science.

C) The National Policy of Education (NPE, 1986): The NPE, 1986 mentions that the objective of science education is to promote inquiry, creativity, objectivity, the courage to question, and develop scientific temper, independence of mind and an aesthetic sensibility. The National Curriculum Framework (NCF), 2000 and 2005 were guided by the NPE, 1986.

D) National Curriculum Framework (NCF, 2000). It recommends that science need to be located in the spirit of enquiry and promote curiosity. It clearly mentions that general science at the level of secondary school education needs to be replaced by science and technology. It highlights the need to discuss indigenous knowledge and contributions of Indians to science and technology. The NCF, 2000, recommends that school curriculum promote, Scientific temper characterised by the spirit of enquiry, problem solving, courage to question and objectivity leading to elimination of obscurantism, superstition and fatalism, while at the same time, sustaining and emphasising the indigenous knowledge ingrained in the Indian tradition (National Council for Education Research and Training [NCERT], 2000, p.40).

E) National Curriculum Framework (NCF, 2005). The focus group on the teaching of science highlights the criteria for the ideal science curriculum. The aims of teaching science (NCERT, 2006a, p.9) are,
• Know the facts and principles of science and its applications, consistent with the stage of cognitive development
• Acquire the skills and understand the methods and processes that lead to generation and validation of scientific knowledge
• Develop a historical and developmental perspective of science and to enable her to view science as a social enterprise
• Relate to the environment (natural environment, artefacts and people), local as well as global, and appreciate the issues at the interface of science, technology and society
• Acquire the requisite theoretical knowledge and practical technological skills to enter the world of work • Nurture the natural curiosity, aesthetic sense and creativity in science and technology

• Imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment • Cultivate 'scientific temper'-objectivity, critical thinking and freedom from fear and prejudice The various purposes such as democratic, cultural and moral are recognised in NCF, 2005 along with utilitarian and economic purposes of teaching science.

F) The Draft National Education Policy (2016): The current discourse on science and technology is in the context of skill development and hails the 'Indian' history of science. Human Resource Development (HRD) minister said- 'the scientific community should pay attention to Sanskrit knowledge and use it for human development' at the Indian Science Congress in 2015.

Reviewing the various policy documents from the 1950s, it is apparent that there has been a shift in perspectives on the aims of science education, from the liberal approach, seen in Mudaliar Commission report, 1953 to a neoliberal one, as apparent in the Draft NEP, 2016. The Mudaliar Commission mentions taking a liberal approach to science and indicates that learning science is for life and to understand the humaneness. In contrast, the Draft NEP, 2016 mentions science and technology as a means for participating in the economy, globalisation and industrialisation thus taking a neoliberal approach. Though privatisation, skilling and employability has entered education since 1986, the skilling of individuals and concerns about employability has reached its peak in 2016 in the draft National Policy on Education (Sadgopal, 2016).

Science textbooks. The textbook is one of the mediums through which the intended aims and purposes of teaching are conveyed. The textbooks are often an important resource for teaching in the Indian context. Kumar (1988) describes the Indian school system as textbookcentred as the teaching revolves around the text. The review of science textbooks often indicates the vast content that it presents (Sharma, 2007) and the way it alienates the learners especially the girls (Bhog, 2002). According to Sharma (2007), science in textbooks is presented as a body of canonical knowledge that the students have to rote learn, rather than an invitation to participate in science practices, such as generation, interpretation and critique of scientific evidence and explanations. The concepts in high school are presented as abstract concepts in isolation often decontextualising it. Teachers' pedagogy and science classrooms. Teachers play a critical role in the way curricula are implemented in a classroom and experienced by students. The more invested they are in the project and associated aims, the more likely it is that students have positive experiences (Sadler, 2009). The way concepts are presented and taught and the teacher's own impression of the purposes of science all leave impressions on what constitutes science among students.

The classroom is an important space where students develop certain kinds of identities and self-image due to the remarks of the teacher, the way other students perceive them and various other interactions. 'The study of science could be liberating and magical or alienating and excluding' for girls (Bindulakshmi and Achuthan, 2012, p. 7). Teachers' distinguish certain students as favourite students and some as slow- learners and their interactions with students depend on many such assumptions about students. The students get the sense of who they are, how they are viewed by their teachers and their position in the classroom. 'The teacher's lack of confidence on the slow learners erodes their own confidence' (Majumdar and Mooij, 2011, p. 101). Teacher's views and the way they interact influences the self-image of the students.

According to Sadker & Sadker (1994), there is a one-sided pattern of classroom dynamics where boys get more attention than females. According to Mahajan's (2004) research, a teacher's preconceived notions about the students' gender led her to ask questions tailored to one gender in a machine science class. At one point, the instructor was talking to the males the whole time while turning her back to the ladies (Peri, 2004). The instructor ignored the females who raised their hands to ask questions as she focused on explaining plant development to the guys. Jandhyala (2004) claims that while observing male students, instructors often stand closer to them. When the guys misbehave, the girls are told to beat him on the head. Since females are seen as being weak, being smacked by one might make guys feel guilty (Rathnam, 2004). Normalising guys as learners is a result of teachers addressing boys more often than girls in mathematics courses (NCERT, 2006b).

The Dynamics of Teaching and Learning in the Classroom Development of the curriculum to address gender inequality cannot happen in isolation from other aspects of schooling, particularly ways of teaching, learning and interaction within the classroom. Whatever the content of the curriculum, equity will not be achieved if

girls are discouraged from speaking, if boys absorb a disproportionate amount of the teachers' energy, nor if the physical environment does not support equal access to education for example, the provision of girls' toilets and wheel chair access. International researches suggests that boys have a disproportionate share of contributions in whole class interaction due partly to their being selected by the teacher more frequently than girls, but also to their ability to create both positive and negative conditions which attract teachers' attention and facilitate their participation and dominant position in classroom interaction.

The guys get valuable experience (the confidence to be heard and reacted to in the public sphere) from their dominating position, which encourages them to engage more actively. As a result, girls may grow used to seeing less involvement from adults and feel marginalised from the activity. Even among educators who are generally supportive of gender equality, there is strong evidence that instructors treat their male and female students differently, which may have a negative impact on females (Jungwirth, 1991; Robinson, 1992; Smith, 1992). It has been shown in classroom observations that males tend to get and demand more attention from teachers (Akpakwu, 2009).

Disciplinary interventions account for a large portion of this. Despite instructors' insistence that they do not pay more attention to females than boys, Kaiser (1991) found that teachers of both sexes tend to lavish more praise on boys of all ages. Research has also shown that instructors often use sex rivalry as a tool to control or inspire their students. The majority of classroom discussions centre on male students, and some research suggests that educators intentionally target male students' interests when planning classes (Wilson, 1991). Teachers have been shown to diminish the accomplishments of girls and they continue to be relatively quiet and "invisible" in the classroom (Stanworth, 2003).

These studies provide evidence that girls' self-esteem and confidence are impacted by unpleasant interactions between males and girls in the classroom. Regardless of the instructors' levels of experience, there seems to be no correlation between the variations in classroom interaction patterns. There is no correlation between instructors' years of experience and students' engagement levels, according to research (Omvig, 2005).

It would seem that patterns of classroom interaction are unaffected by the gender of the instructors either (Jungwirth, 1991). Across the board, male students are more often interacted with by teachers than female pupils. Nevertheless, there is a strong correlation between instructors' prior training in effective classroom interaction tactics and student conduct, with teachers who have received training regularly fostering a fair learning environment.

Teachers' low expectations of students' intelligence and the lack of meaningful feedback they provide are two factors that contribute to females' struggles in the classroom. In addition, some teachers say they enjoy teaching boys more than girls especially if the girls are seen as passive. Girls' low expectations of themselves contribute to the problem, as does a lack of female teachers in high-status subjects such as maths and science. Textbooks often reinforce the low expectations of women and girls, as do curriculum and examination materials, while the use of physical space in schools also marginalizes girls.

The curriculum is only as good as the teachers who deliver it. Despite extensive gender inequalities outside school, teachers can make a difference inside school. If teachers assume that a girl can learn mathematics, it will affect their approach to teaching girls and their expectations of what girls can achieve in their subject. According to Akpakwu (2003), if teachers are seen as facilitators of learning, rather than merely deliverers of knowledge, then they are obliged to ensure that all children learn.

A Gender-equitable Approach to Schooling Gender equity can be associated with a superficial focus on girls' education to the exclusion of boys. There is a need to go beyond simple access issues and ensure a comprehensive understanding of gender. According to Skelton as cited in Amott (2004), a gender-equity programme should make an assessment of the school by looking at four key questions. 1. What perceptions of masculinity and feminity are children bringing to school, and what are they acting out in the classroom and the playground? 2. What are the dominant images of masculinity and feminity that the school conveys to them? 3. Is gender equality a concern in terms of what the school wants and expects of its teachers? 4. What initiatives, strategies, and projects, can the whole school undertake to develop a program for gender equality? Making schools more "girl-friendly," and gender equitable means challenging the culture of authority, hierarchy, and social control in the majority of schools. At a general level, it would mean changes to curriculum, the breaking down of hierarchies and power networks that exclude girls and women. Head teachers and teachers would

have a greater understanding of the conditions which lead to bullying, racism, sexism, and homophobic behaviour, replacing them with more successful forms of intervention. In addition, some value would be placed on students, experience and knowledge, with students being more actively involved in planning and evaluating their work. Students would be encouraged to challenge narrow-minded concepts, and prejudices, and envision an expanded and divergent future (Weiner, 2004). This calls for making teaching and the curriculum gender equitable in schools.

Making Teaching and the Curriculum Gender Equitable

There is a great deal of work being done at national and international levels to influence curriculum change to include gender equality, and to make governments accountable. In India, curriculum design for non-formal education, through academic-activist partnerships, was put in place in programmes such as the National Literacy Campaigns. For instance, curricula resource manuals were developed for a residential course for young women and numeracy manuals were prepared using women's indigenous knowledge (Akpakwu, 2009). In India, experience has shown that developing courses and curricular for out- of- school and adolescent girls calls for strategic and effective partnership in practice (Sharma, 2003). This would ensure a sharing of expertise between university professionals, women groups, Non - Governmental Organizations (NGOs), and education functionaries, for the transforming potential of the course to be fully explored.

In schools and colleges, the curriculum is usually full, which means it is not easy to integrate a gender equity perspective in the design, content and teaching approaches of the many subjects that teachers may have to cope with. Moreover, curricula are often developed by experts and owned' by the state, so it is difficult to lobby for change where this might be seen to challenge governmental control (Akpakwu, 2009). But, where diversity is recognized and participatory processes are employed, women and girls from different backgrounds can participate in discussions about curricula decisions and how they are represented — considering that they are diverse groups. When considering how teaching and the curriculum can be made gender- equitable, the following areas need attention.

Curriculum content: there is need to consider what girls from poor, and marginalized environments, are offered by their schooling, and to provide, for example, literacy learning in a way that enhances their confidence, so that they can begin to transform the lives. Learning methods: often, images in textbooks are simply 'check-listed for their portrayal of gender images. Children do not necessarily have simplistic, preconditioned responses to images in textbooks, and need a more sophisticated understanding of and response to how children learn about gender textbooks. Language of instruction and literacy: children who are geographically or culturally marginalized from mainstream education may find themselves being taught in a language that they do not use. Girls and women often have less access to, and use of national "prestige" language than men. In what ways is the language of instruction empowering or disabling for girls and boys differently and how can this be ameliorated?

Methods of evaluation and assessment: examinations tend to dominate assessment, but other methods should be used, such as continuous assessment. In addition, "girls could have more equal opportunities in school if teachers talk to them more and encourage them, for instance by giving them more prizes for participating in different classroom activities". For teaching and the curricula to be gender equitable in schools, it is important to properly educate teachers on gender quality teaching through the courses and practical materials that are provided. This is discussed below.

Educating the Teachers

(a) Types of gender training courses : Governments have a responsibility to develop gender equality in teaching through the courses and practical materials that they provide. Teacher education needs to equip teachers to promote an understanding of the profound nature of gender inequity and to overcome the resultant bafflers to learning. Ensuring that gender equity is a central theme throughout a programme of teacher education, rather than delivered in one-off sessions, is likely to ingrain understanding more effectively. Training needs to help teachers to develop practical solutions, and should be accompanied by monitoring and follow-up support. The efforts of pre-service training institutions, providers of in-service and ongoing professional development, need to be co-ordinated, and well documented. Building networks of teachers to work together or collaborating through school clusters and teachers' centres are ways of sustaining training and providing ongoing support for teachers and education officials.

(b) Relationship and style of learning: The teaching process is about the relationships between teachers and learners in schools. What is considered to be 'good' teaching and what promotes successful learning will change, according to who is involved and the context in which the learning takes place. Teacher's education need to be able to work with different learning styles. Teacher education needs to equip teachers to work through some of the implications of local gender issues, and to support teachers in developing the confidence to encourage participation from pupils and the local community in shaping a vision for gender equality. For example, as Akpakwu (2005) has observed, men tend to dominate school committees, while women fi1lfill the more domestic roles. The school needs to interact with the local community to ensure that significant local issues of gender inequality (for example, abuse of girls by their peers and by teachers) are analyzed and addressed.

(c). Teaching and living gender equity : Teacher education also needs to address not only how teachers and educational managers leach gender equality, but how they live this in their private lives, changing personal behaviour and challenging some of the deeply held assumptions that perpetuate inequalities. Student teachers, and in-service teachers, need opportunities to examine and understand their own gender identities, and to understand how gender discrimination takes place in schools, as well as theft role in addressing it. For example, teachers have to learn how to make their students become aware of their sexuality and, in this age of HIV/AIDS, provide a model of risk-free sex behaviour.

(d). **Linking the School and the Community**: In tandem with the school, clubs and parents'/students'/teachers' associations can provide venues and forums where strong gender-equality messages can be explored and reinforced. Different types of extra-curricular activities can help children who have been silenced to articulate their needs. There is need for teachers, NGOs, and community-based organizations to work alongside parents and communities to think about the ways in which they can support boys and girls to learn well at school, in order that both can participate in the society. It is in this area that the activities of clubs in Liberia, a West African Sub-Region become very useful to India. In Liberia, the forum for African Women Educationalists (FAWE) has introduced after-school clubs for girls in primary and junior secondary schools to encourage them to continue with schooling, and to help them analyze their educational problems and find ways of solving them. The girls are mostly living independently in severe economic hardship, and struggling to continue schooling in a social environment characterized by violence and displacement. Perhaps the experience of the Liberian situation can be used in the Niger Delta Region of India where girls and boys have been deprived of education due to environmental degradation caused by oil and violence that have made boys and girls to live in severe economic hardships without education.

Conclusion

  This paper discussed the content and delivery of education and how it can reflect and reproduce gender inequalities in the curriculum, teaching and classroom interactions. It advocated for a gender-equitable approach to schooling, ways of making teaching and the curriculum gender-equitable in schools and the ways of educating teachers on teaching. The paper concluded that making schools more "girl-friendly" and gender equitable means challenging the culture of authorities, hierarchy, and social control in the majority of the schools. It would also mean changes to the curriculum, the breaking down of hierarchies and the power networks that exclude girls and women. The paper recommended changes needed to ensure that educational provision will promote gender equality in schools in the new millennium. Classroom discourse and interactions construct and reproduce gendered   capabilities of learning science. The ideal and good constructed in the classroom seem to   be guided by the notion of merit, performance and efficiency. Students aspirations and subject choices are located and analysed in the context of social   positioning of the family. Though girls have high aspirations, this study finds that their   narratives are located in domesticity and traditional notions by textbooks, teachers and families. The urban lives and aspirations seem to create new subjectivities and gender. Girls are expected   to perform well and have high aspirations. Both the expectations and aspirations for girls seem gender to be changing. At the same time there are certain stereotypical notions and families decide what girls could choose. The aspirations for girls are such that they are educated enough and course play a supportive role if need be. The students background and learning and foregrounds are gender distinct and polarised. In situating the learning of science within the contemporary economic context, this study attempts to understand the imagination of science education itself. This research points out that the discussion on nature

of science need to be explicit and this has to find an important place in the curriculum. It stresses that the science curriculum has to recognize social justice as gender equity its important aim. This resech reflection among teachers regarding nature and method of   science, their perceptions and notions about gender can be identified and raised during teacher   training which this research points to. The teacher training along with redesigning of   curriculum and textbooks might help the learners to engage with science effectively.

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