Marching Towards Inclusive Education: Are We Prepared for Inclusive Science Education?

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The paper reports the historical background of inclusion in education and the status of inclusion in education in India. The article concludes that in spite of several efforts by the Government and other educational agencies in India, the dream of inclusive education for all students with differential abilities-disabilities or belonging to any social or cultural group remains unfulfilled. When focussing on science education, one finds that there is a lack of data on status of students from different marginalised backgrounds in science education, yet from the little data found it is evident that science education is not inclusive. The possible reasons seem to be: lack of positive attitude towards inclusion, lack of institutionalisation of strategies which have been made by isolated educators to make science inclusive, lack of use of adaptive technologies and low expectations in science from students with disabilities.

Introduction

Inclusion is a broad social model of adapting organisational or community facilities and processes to diversity, thus including persons with disability and other vulnerable or oppressed groups. According to the Action Plan for Inclusive Education of Children and Youth with Disabilities (MHRD, 2005)- "In its broadest and all encompassing meaning, inclusive education, as an approach, seeks to address the learning needs of all children, youth and adults with specific focus on those who are vulnerable to marginalization and exclusion. It implies all learners, young people - with or without disabilities - being able to learn together through access to common pre-school provisions, schools and community educational setting with an appropriate network of support services". It is important to note that we have a general philosophical approach that the "fight of one is the fight for all", though in this paper our focus is on the inclusion of students with disabilities in education.

A historical background of inclusive education

The history of the inclusion movement began in India with the National Policy on Education, 1968 (MHRD, 1998), which along with an emphasis on education of girls and backward groups of children envisaged the expansion of educational facilities for children with disabilities through integration in regular schools. This policy was followed by the Integrated Education for Disabled Children programme (MHRD, 1974) to promote education, and ensure retention of children with mild to moderate disabilities in regular schools.

The formal movement of inclusion spread through the Normalization principle, which is based largely on the writings of Mikkelsen, Wolfensberger, and Nirje. This principle suggests that "you act right when making available to all persons with intellectual or other impairments or disabilities, patterns of life and conditions of everyday living that are as close as possible to or indeed the same as the regular circumstances and ways of life in their communities" (Bengt Nirje, as quoted in Billimoria, 1993). This principle was reflected in the Declaration on Rights of Persons With Disabilities by the United Nations, General Assembly, in 1975 in its promotion of *integration* of persons with physical and mental disabilities in normal life.

The initial movements made towards integration of the disabled in education, speeded after the declaration of the year 1981, as the 'International Year of Persons with Disabilities' (IYPD). This resulted in several policies and plans in countries all over the world towards removing obstacles that prevent persons with disabilities from exercising their rights (Tundawala, 2007). Some of the policies and programmes that followed IYPD in India are: Project Integrated Education for the Disabled, launched by Government of India (NCERT 1987), the Programme of Action (MHRD, 1998), the Rehabilitation Council of India Act enacted by Parliament of India (RCI, 1992), the District Primary Education Programme, (MHRD, 1997), the Persons with Disability Act, (MLJCA, 1995), and the Sarva Shiksha Abhiyan (MHRD, 2004).

At the same time there was a shift of focus from *integration* to *inclusion* initiated by UNESCO (1994), through the Salamanca statement on "special needs education to all excluded children in regular schools with inclusive orientation", which advocated the development of inclusive education systems for all children. Finally, it was

after the movement on equality of opportunity in education the 'Education for All', (UNESCO, 2000), that "the right to education for persons with disabilities towards inclusion", got established and 'inclusive education' became a terminology used for including all groups of children, those socially, economically or those excluded due to disabilities (Miles and Singal, 2008).

In India, the shift of the educational model from *integration* of children with disabilities to *inclusion of all* can be observed in the National Curricular Framework (NCERT, 2005), the National Policy for Persons with Disabilities (MSJE, 2006), and the National Curricular Framework for Teacher Education, NCFTE (NCTE, 2010), which emphasised the need of making learning environment appropriate not only for children with disabilities but also for all children with diverse backgrounds and needs.

Need for inclusion in education

According to UNESCO (1994), regular schools with an inclusive orientation are most effective in combating discriminatory attitudes, building an inclusive society and achieving education for all. Research studies have demonstrated the effectiveness of inclusion in education practice, the positive effects on the educational outcomes of children with disabilities in inclusive settings (Katz & Mirenda, 2002), and the lack of any significant difference in the development of children with special needs in inclusive and special settings (Lal, 2005). The foreword of UNICEF (2003), focussed on inclusive education in India, estimates that "70% of children with disabilities, including those with mild mental retardation, can attend regular schools provided the environment is designed to be accessible and the institution is willing to accommodate them".

Education and marginalised groups in the Indian context

In India there is confusion about what groups of students are to be considered while focussing on inclusive education. This confusion is exacerbated by the existence of separate Government Ministries to look after the education of children with disabilities (Ministry of Social Welfare) and other children (Ministry of Human Resource Development). Different policy documents in India have used different terminologies for groups of children who find themselves disadvantaged in the education process. These disadvantages have ranged from social, cultural, economic, linguistic or those due to location to gender and disability. The NCFTE, (NCTE, 2010) identifies these excluded groups as children with disabilities of various kinds, or with learning difficulties, and socially and economically deprived groups of SC, ST, minority and other communities, girls and children with diverse learning needs. The UNESCO also identifies marginalised groups of children in education on the basis of remote location, poverty, gender discrimination, disability, language and traditional or cultural deprivation (UNESCO, 2010)

Persons with disability and their education

Persons with disabilities form the world's largest minority group. Around 10% of the total world's population, or roughly 650 million people, live with some disability. And the situation is worse in the so called developing countries, who according to UNDP, house 80% of persons with disabilities (United Nations, 2010). There is a vicious circle or two-way link between disability and poverty; poor people are more at risk of acquiring a disability because of lack of access to good nutrition, health care, sanitation, as well as safe living and working conditions. Once this occurs, they face barriers to education, employment, and public services that pushes them further into poverty.

Total population—1027015247				
Total disabled population – 21906769 (2.1% of total population)				
Visual --48.5%	Movement-- 27.9%	Mental-- 10.3%	Speech-- 7.5%	Hearing-- 5.7%

Table 1. Distribution of persons by the type of disability in India (MHA, 2001)

Three major legislations on disability that have been passed by the Government of India and have been enacted and implemented at both the Central and State level are: the Rehabilitation Council of India Act (RCI, 1992), Persons with Disability Act (MLJCA, 1995), and the National Trust Act (MLJCA, 1999). Education of children with disability has been part of the National Policy on Education and the Programme of Action (MHRD, 1998) but as compared to the national literacy figure of around 65 percent, the literacy levels of the population with disabilities is only 49 percent. Literacy rates for the female disabled population is around 37 percent

compared to national average of over 54 percent for the female population and the literacy rates for the male disabled population is 58 percent compared to around 76 percent for national male average literacy. According to the National Sample Survey Organisation, (NSSO, 2002), of the literate disabled population only 9% have completed secondary and higher education. Table-2 presents some numbers on the education of persons with disability.

Category of disabled children	Number	Source
In school going age	3430000	Census India, 2001
Children with disability having access to education with appropriate support	137200 (4% of the above)	MSJE (2010)
Disabled youth in age range to attend Universities	3160000	NCPEDP (2011)
Disabled youth in Universities	37920 (1.2 % of the above)	NCPEDP (2011)

Table 2. Status of education of children with disabilities

Need of inclusiveness in science education

The constitution of India has acknowledged the significance of science for a rational and egalitarian society. Reflection of this acknowledgement is seen in the Article 51A (h) of Indian constitution, which makes it a fundamental duty of every citizen "to develop the scientific temper, humanism and the spirit of inquiry and reform" (Indian Kanoon, http://www.Indiankanoon.org /doc/560422/). Education for all and equal opportunity in employment is guaranteed by the Constitution of India. Article 21A: Right to Education (RTE) places the responsibility on the State to provide, "free and compulsory education to all children of the age of 6 to 14" (MLJ, 2009), thus, making education a fundamental right in India. The constitution also gives all its citizens a fundamental Right to Equality through Article 15 (i) and 25 (ii.b) for social equality and equal access to public areas which includes all schools and colleges maintained by public funds. Article 16 (i) guarantees equality in matters of public employment, while for promotion of social justice, Articles 16 (iv) and Article 335 allow reservations in favour of backward groups in all public services (Indian Kanoon http://www.indiankanoon. org/doc/1942013/, /631708/, /250697/ & /1113850/).

Status of Inclusiveness in Science education

Despite a constitutional obligation for scientific literacy in India, science education acts as an exclusionary device. The criteria of high over-all percentage in class X to get admission to science course in junior college disproportionately filters out many children from lower socio-economic levels. The use of English as a medium of instruction of science after class X in many parts of India creates an elitist language barrier. That limited number of schools offer science after class X and that these are often located in select urban locations and are also elite private schools creates another filter as do the poor facilities for science learning in schools located in rural and backward areas at elementary and secondary level. Besides, the lack of supportive facilities hinders science education received by children with disabilities and impairments. Even after 60 years of the Indian Constitution, one can easily find instances of unequal access to science education in India. According to some science educators the elitist nature of science education tends to exclude (Fensham, 1986). As described by Aikenhead (2009), p. 1, "Science and technology education in schools has traditionally served an elite group of students" and the elitist nature of science discourages marginalised and low achieving students to opt for science for their higher studies.

The India Science Report (Shukla, 2005) states better employment opportunities are available to persons with higher qualifications in science and related courses, thus, the constitutional obligations for equity actually remain ineffective due to the lack of access to science education among the weaker sections of society. The National Policy of Education, 1968, (MHRD, 1998) acknowledged the role of science education in accelerating the growth of national economy, and recommended science as an integral part of general education till the end of school stage. Extending the efforts of previous policy, the NPE 1986 (MHRD, 1998), made efforts to "extend science to the vast numbers who have remained outside the pale of formal education" by curricular reforms. But all these steps are insufficient due to lack of focus on the issue of 'Science for All'. A decline in enrolment in science education at the higher levels has been reported (Mukherjee & Varma, 2001 and Garg & Gupta, 2003). Interpreting the findings of the India Science Report (Shukla, 2005) provides reasons for the decline. The Report

states that at the +2 level, of the students who did not opt for science, 10% said that they did so because science is costly, while another 45% found science uninteresting. This points to the ineffectiveness of the attempts to make science accessible.

Barriers to inclusion in science education

Attitude

Students from various disability groups have been found to suffer from low expectations from teachers, parents and societal members, thereby creating a poor self concept in them regarding science education (Fraser & Maguvhe, 2008). A common attitude among educators, parents, and peers that 'they cannot study science' is the foremost barrier to inclusion in science education. UNESCO (2010), identifies public attitudes as a barrier to equal education of people in India. Research indicates that negative attitudes towards persons with disabilities may lead to low expectations which in turn can lead to reduced learning opportunities (Sharma, Forlin, Loreman and Earle, 2006). Researchers have found that educators having relatively positive attitudes towards inclusion of children with disabilities also have a reasonably good knowledge and relatively low concerns about it (Changpinit, Greaves & Frydenberg, 2007). Sharma, et al. (2006) suggest that additional training and/or experience with disabled persons leads to development of positive attitudes in pre-service teachers towards people with disabilities and more confidence in implementing inclusive practice.

Educational aspects

An education system focussed on competency in learning of 3R's cannot move further to the learning of products and processes of science through experiential learning, thus leaving behind a large section of learners marginalised. In the case of parents of children with disabilities, the "distrust in both the special and mainstream education systems" leads to forcing them to keep their children at home "for fear of their abuse or neglect in the classroom" (Giffard-Lindsay, 2007). In some states of India, the medium of instruction of science at senior secondary level has formally been declared to be English, which may create a strong cognitive barrier for students from marginalised groups. The need to learn a foreign language in order to learn science creates an extra cognitive load on students.

Lack of adaptive technology

Students with disabilities generally have different kind of learning needs, modes of perceptions and preferences, so a modified "access to content materials that are consistent with their learning preferences and needs" (Broderick, Mehta-Parekh, and Reid, 2005) are needed to be used in science classrooms and laboratories. Such adaptations may include use of adapted laboratory equipments with tactile markings, providing hearing or speech aids to students, provision of a facilitator to support a student's access, use of audio-recorded texts; Braille, large print materials, tactile marked graphs, models or diagram, peer support, additional time, fewer items or questions to address, multi-modal presentations etc. But a general survey of Indian classrooms shows a marked shortage of such resources.

Classroom factors

The World Bank (2009) has stated that in India the quality of public secondary education is "alarmingly low". Some factors for this state of affairs are the high teacher-pupil ratio in science and other classrooms, lack of physical facilities and inclusive infrastructure for those with disabilities, lack of training to science teachers either pre-service or in-service, to "address the learning needs of all children including those who are marginalised and disabled" (Julka, 2012), lack of pedagogical research for effective teaching in inclusive settings, lack of inclusive culture and inclusive practices in schools, lack of "knowledge base about various impairments... and how it effects the learning process" (Auluck, 2012) and lack of special co-educators in schools. Gillies & Carrington (2004) point to a dire need to review the attitude, organisational structures, curriculum and pedagogical practices of science education to guide a transformation regarding inclusion of all children.

Possible effects of inclusion

It can be envisaged that putting a thrust on inclusive science education would not only be beneficial to the career of students with diverse cultures and learning needs, but also to the science education, science and thereby to the human society. Inclusion is not merely a way of education, rather it is a way of progress of humanity which

considers the benefit of all. Moreover, by bringing new dimensions of cultural and sensory perceptions into science a more holistic and lively progress may get boosted up in science. The only need here is to implement the body of research in inclusive education from the initial stage of planning education be it curriculum, infrastructure, training or the social aspects of education.

Taking an extreme stand: Can students with visual impairments be included in science classrooms?

Researchers have undertaken various steps to answer the above question. Hill (1995) in her study concludes that with ingenuity, a little money and much time, even students with visual impairments can be given nearly full access to the practical and diagrammatic aspects of science, thereby improving the quality of their education. Beck-Winchatz & Ostro (2004) acknowledge the inaccessibility to graphical materials to be a major obstacle confronting blind and visually impaired students in their science education. They report the effective use of three-dimensional scale models of near-Earth asteroids to teach space science to blind and visually impaired students through hepatic perception. Fraser & Maguvhe (2008) in their study emphasise multi-sensory approaches, learning mediation aids and curriculum adaptation for teaching science to learners with specific disabilities. Kumar & Stefanich (2001) in their paper suggest various strategies through examples from different levels of education to make general science classrooms and laboratories inclusive.

Conclusion

An inclusive science education, which although is not a key to success, ensures an enlightened citizenry capable of making rational decisions. To make the Right to Education a real success, science education should be given a boost by making it all inclusive. The research body exemplifies that inclusion in science is possible but the statistics give evidences that in spite of several efforts made towards achieving inclusion in education, the inclusion movement in India has not yet lost its inertia. It is most imperative to focus on what are the barriers to inclusion. The discussion in the paper proposes that science education can be made inclusive- through development of positive attitudes towards inclusion in science, improving academic environment in classrooms, systematization of strategies to make science education inclusive, use of adaptive technologies and raising expectations of students who have disabilities as well as societal expectations.

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