Tactile Map Book for Students with Visual Impairments
A Step towards Inclusive Education in India

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Abstract

The paper highlights the significance of teaching-learning of Geography to students with visual impairments with the help of tactile maps for enhancing their map reading skills. The study reveals the status of teaching-learning of Geography to visually impaired in schools and availability of teaching-learning materials in Geography for students with visual impairments in the country. The development of an innovative tactile map book based on innovative technology for students with visual impairments and their responses on the map book bring some hope for future in qualitative improvement of teaching-learning of Geography. A conscious effort has been made to develop tactile map book in view of crucial pedagogical concerns related to the subject and of the learners.

Introduction

Geography is the study of relationship between humans and environment. It helps to understand the impacts of human behaviour on environment and *vice versa*. The skills and knowledge of the subject acquired by students enable them to understand their own environment better and appreciate how it differs to others. Teaching Geography in school for blind and partially sighted children presents at the same time a challenge and a great responsibility.

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Geography is of great importance for entire personal development of blind or partially sighted pupil (Brvar, n.d.). Children need to understand how to track effectively, follow verbal instruction and search independently (RNIB, n.d.). Mapping skills, like all tactile and scanning skills, need to be taught from an early age. Schnotz and Kulhavy (1994) rightly mentioned that when created with a purpose and used correctly in classrooms, graphics such as maps can serve as instruments that support learning and enable the learner to acquire meaningful and important information. In doing so, maps can and do serve an important instructional function. Developing an understanding of our world and the lives of its people is crucial for all students. Students with vision impairments may need extra help to fully access the subject like Geography. Stuart Snowdon (2003) believes that with a little forethought and imagination, and a few extra minutes spent on resources and planning, you should be able to offer a student who is visually impaired the opportunity to get the full benefit of a good geographical education. Geography offers blind and partially sighted young people essential tools for understanding the world they live in and lots of opportunity to develop useful transferable skills like coordinates on the map.

The world over, map work is one of the most challenging areas of school curriculum for blind and partially sighted children and is important in Geography. However, a map in the form of simple directions and routes is a very valuable skill for a young person with vision impairment and is vital for her/his developing independent orientation and mobility. Students with vision impairments may have really lesser opportunities for incidental learning and the reinforcement of concepts and knowledge of the world around them. For example, even a passing glance at a flower pot gives a fully sighted child a wealth of images and information which may not be readily accessible to a child with sight impairments. For this reason, it is important to include as many multi-sensory 'real life' experiences as possible to enable blind and partially sighted children to develop a general understanding of the world. Sighted map readers take in the whole map at a glance. That overview helps them see details in context. But when fingers do the looking, they tend to take in the contents of the map one press of the fingertip at a time (Pennisi, 1992).

Status of Teaching-Learning of Geography to Students with Visual Impairments in India

Geography is one of the components of social science up to secondary level school curriculum in India. Social science subject incorporates History, Geography, Political Science and Economics from Classes VI to X. Generally, in all schools including government, semi-government and

private, only one subject teacher is supposed to teach all the four subjects in social science. It has been observed that in most of the cases, non-specialist in Geography is bound to teach the subject from upper primary to secondary stages. These teachers are not adequately prepared to teach map skills in the classroom during their pre-service education course to sighted students even, let alone blind or partially sighted. Apart from that, during interaction with teachers and visit to several teachers' training colleges and schools of the country, it has been observed that there is an acute shortage of teaching-learning materials in Geography for students with visual impairments. Moreover, Geography textbooks for visually impaired are generally available in Braille text only without any graphical images. Therefore, in order to explain a theme or topic, a teacher often prepares sketches, maps or diagrams with the help of hard boards, thread, wool, grains, pearls and metal pins, etc. Most of these materials are developed during pre-service special teacher education course and later used to display in the classrooms. These teaching-learning materials are neither accurate nor durable as far as their quality is concerned. One or two such materials may be seen displayed on the walls of classrooms in every special school. Since these materials are manually developed, therefore mass production of such materials are not feasible. In view of large number of students with visual impairments, such materials are seldom used in the classroom during teaching-learning process. Besides, during question paper analysis of several state education boards and Central Board of Secondary Education (CBSE), it has been observed that maps-based questions are replaced by theory questions for blind students. This proves reluctance of school examination boards towards mapping skills in students with visual impairments as well as inability of teachers to transact map skills to the students due to unavailability of resources in the schools. Therefore, the main objective behind preparing the tactile map book was to supplement the teaching-learning materials for teachers and students with visual impairments for qualitative improvement of teaching-learning of Geography and to promote inclusive education in schools.

Review of Existing Tactile Map Books

In order to assess needs of the students with visual impairments and to know about their difficulties with the currently available materials, a review meeting was organised with subject experts, special teachers and teacher educators at NCERT, New Delhi, during 2013. The interaction with teachers and teacher-educators (both sighted and visually impaired) revealed scarcity of tactile educational materials in the country. The review of tactile map books developed by

different organisations (national/ international) was done on the criteria, such as physical structure of the map book (which includes size, shape, weight, quality of paper, binding), number of information on the map, methods used for information on the map, description of map in Braille (*Open/ Contraction*), guidelines for users in the map book, language used in the map book (Braille, and text), integration of pedagogy with the content of maps and cost of the map book. It was found that in the special schools, teachers and educators did not have access to such materials. One of the map books was quite big in size and heavy. It was not easy to carry or handle the map book during classroom transaction but was suitable for resource room or library. The other map book was light in weight but binding was severely tight which made it difficult to open up. Tactile pictures or diagrams have to be very simple for a blind child to use effectively, since they need to be explored in a serial manner (Tobin *et al.*, 1997), whereas these map books have used some sheds or lines which could not be differentiated by visually impaired persons. One of the major characteristics of all the map books was that states of India were shown altogether on one sheet and later split in different sheets. Moreover, three or four states were clubbed together and were shown on one sheet in isolation, therefore visually impaired students could not relate the location of the states shown on separate sheet with the map of India where all states were represented altogether. Besides, height of all sheds shown on the maps was same which made the distinction between them more complicated. More number of information on A4 size map was one of the major drawbacks of these map books. Descriptions of the maps were given in Braille and English or Hindi, but the contents were quite similar to any other geography textbook. In these map books, *Contraction Braille* was used to utilise more space for description, however, during review workshop, special teachers said that students of Classes VI to VIII have been introduced to *Open Braille*, which is comparatively easier. None of the map book had given instructions or guidelines for teachers or students before introducing the maps in the book. Preface of the map book included only the purpose and objectives of the development of the materials. It was observed that the plain description of maps in Braille in the map books could not engage students to learn the concept with interest. Above all, the map books developed in India were not available for purchase. And one map book, which was imported by an NGO, was available for about ₹ 5000. Keeping in view the quality of the maps, this map book was not worth purchasing even for libraries.

Keeping all the above in view, an initiative was taken by NCERT to develop a quality, user-friendly and cost-effective tactile map book for students with visual impairments. A

thorough review of literature available at national and international level was done for conceptualisation of the theme and design for the map book. The study materials and guidelines developed by Royal National Institute for Blind (RNIB), Blind Association of North America (BANA) and The Swedish Braille Authority, were studied in detail for simplification and conversion of 2-dimension to 3-dimension for tactile graphics and maps. Since these guidelines are based on several researches and experiences, therefore a few of them have been contextualised as per our need. The subsequent steps taken for development of the map book were introduction of simple diagrams in the beginning of the tactile map book which lead to develop spatial concepts like cardinal directions, scale, latitudes and longitudes among students. Keeping in view that a simple diagram which works may be far more effective than a beautiful diagram which is too complex, information for maps were prioritised to avoid visual overload. Activity given at the end of contents of each map and diagram ensure that the whole exercise is enjoyable. Since high levels of concentration are required to piece together information to create an overall mental map and the student must feel that what they are doing is worthwhile, hence, teachers must stimulate interest among students for things they are not aware of.

Validation of the Tactile Maps and Diagrams

During development of the tactile map book, diagrams and maps were methodically tried out with students with visual impairments of special schools located in different parts of the country such as Government School for the Blind, Basishtha, Guwahati, Assam; the School for the Blind, Narendra Nagar; Ramakrisna Mission, Kolkata, West Bengal; Shri Hanuman Prasad Poddar Andh Vidyalaya, Varanasi, U.P; Bhima Bhoi School for the Blind, Bhubaneswar; the National Association for Blind (NAB), New Delhi; Saksham School, Noida; Special School for the Blind, Durtlang, Aizwal, Mizoram; Rajkiya Pragya Chakshu Andh Vidyalaya, Udaipur. Moreover, for improvement of the tactile maps information on maps and contents have also been upgraded and modified on the basis of views and feedback from special educators obtained during several meetings for development of materials for children with special needs and in-service teachers' education programmes conducted by NCERT at the national level. In this connection, Dr. G. Victoria, Professor, Department of Special Education, Faculty of Education, Avinashlingam Institute of Home Science & Higher Education for Women University, Coimbatore, comments that all parameters have been met for developing this material such as size of the map, scale, latitude, longitudes, sheds, number

of information on one page, etc. From all aspects, this map book is amazing (it) should reach all schools of the country. The tactile map book has been acclaimed by stakeholders too. However, there is always scope for improvement to provide quality materials to learners.

The Important Features of the Latest Tactile Map Book Developed by NCERT

The review and analysis of the available study materials and interaction with students and teachers led us to believe that studying many diagrams and maps would be extremely exhausting for students who have not yet exposed to such materials. Therefore, technical aspects of tactile graphics were given due importance for better ways to present information. As per the guidelines of RNIB, size of the map should not exceed a handspan, Braille paper size map book was selected to develop the map book. Symbols for the maps were chosen carefully and were created with the help of moulds developed by 3D printers. One of the objectives of the development of the map book was to make it cost-effective to reach out to large number of students in the country. Hence, thermoform sheets were preferred over swell paper for making tactile graphics considering cost and durability. *Duxbury* software tools have been used for putting Braille labels on the maps and diagrams.

Themes of the map book were identified with the help of experts, teacher educators and special teachers, keeping in view basic concepts and over all curriculum at the upper primary stage in Geography in the country. Themes have been arranged in such a manner so that learners move from simple to difficult concepts or information. In the beginning of the tactile map book, clear step-wise guidelines have been given for teachers to develop fine psychomotor skills among students with visual impairments for making the best use of the map book.

All diagrams and maps have been presented in the map book in a graded and sequential manner, gradually blended with the conceptual development. It has been realised that difficulties in access to maps may be overcome if the map is broken down into component parts. For a congenitally blind child, concepts such as direction and scale are quite difficult. Therefore, the map book begins with the diagram of cardinal directions. Explanatory note of the diagram in Braille and English gives clear instruction to students how to identify directions by moving their fingers on raised lines. This kind of simplification, undoubtedly, has increased the number of maps, but considering the limitation of learners, maps have been modified for conceptual clarity. In all maps, India has been presented inside the rectangle. In

the beginning, the learners have been given instructions to move their fingers on rectangle and later boundaries of India to understand the difference between straight lines of rectangle and curved boundary lines of India. Due to striking difference in thickness and pattern of lines, students become familiar gradually with the international and peninsular boundary lines of India. To make students understand the extent of India on the map, latitudes (8^0 N and 36^0 N) and longitudes (68^0 E and 97^0 E) of maps have been marked with slightly raised thick point and Braille at the outer margin of rectangle.

Other themes of the tactile map book include scale, latitudes, longitudes, outline map of India showing distinct international and coastal boundaries, political map of India, physiographic divisions, India and its neighbours, and continents and oceans. Considering the limitation of learners, maps have been split-up in parts for better comprehension and conceptual clarity. Though it is a complex process to move fingers from one piece of information to another, returning to check the relationship of the pieces and then build a mental picture of how the pieces 'fit' together. In this context, political map of India with administrative boundaries of states was split in eleven sheets. On each sheet 2–3 new neighbouring states have been introduced inside the boundary of India, so that location and association may be established among states within the boundary of India. It is expected that this kind of organisation of states on different sheets will develop in the learners a sense of space, direction and place. However, keeping in view the small size of north-eastern states and difficulty to distinguish the boundary lines of each state inside the boundary of India, the location of these states has been shown on separate sheets. Name of each state in code has been written in Braille within the state boundaries.

Therefore international, national and state boundary lines, sea and land surface, etc., could be easily differentiated with the touch. The map of rivers shows only a few major rivers of the country, the uniqueness of this map is that unlike other tactile map books it shows direction of flow of each river by including a raised point at the origin place of the river. On any ordinary map, sighted students can very well identify the direction of flow by noticing arrows along with the river. But in the tactile map book, arrow mark along with the river creates confusion among students, therefore after several attempts of trial and error a raised point with specific size was identified to show the origin of the river which has been very much appreciated by students and teachers of special schools. Similarly, information given on one map, major physiographic divisions of India, *i.e.,* mountains, plateaus and plains has been again split-up into three maps for the convenience of the learners because these learners observe the

map through their fingers, gradually and in pieces and form a mental image. It is difficult to comprehend several information on one visual. Description of each diagram and map has been given in Open Braille instead of *Contraction Braille* keeping in view that Braille requires a quite precise tactual discrimination ability, and the highly contracted nature of Standard English Braille with its complex rules governing the use of the contractions and with many of its signs having multiple meanings, cannot but impose substantial cognitive demands upon the learner (Tobin *et al.*, 1997). Use of Braille and English on the same page in the map book helps both sighted students and visually impaired to read the map book together and helps to promote inclusive education environment in the classroom. While developing description of the maps, emphasis has been laid on integration of pedagogy with the contents, hence, explanatory notes along with each diagram and map includes clear instructions in lucid language for students to find the location and characteristics of features by moving their fingers on specific part of the map. Each map and diagram of the map book incorporates an interesting and simple activity which encourages learners to locate the exact place on the map. Another important aspect which makes this map book more usable among stakeholders is availability of its audio CD in both Hindi and English versions. Moreover, the audio versions have been developed digitally in *Daisy* format which allow learners to navigate any topic or activity of the map book directly on computer.

The Way Forward

India has about three crore disabled population and more than fifty lakh visually impaired persons as per Census 2011. UNESCO (2015) in its report entitled *Education 2030, Towards Inclusive and Equitable Quality, Education and Lifelong Learning for All,* emphasises that we therefore commit to making the necessary changes in education policies and focusing our efforts on the most disadvantaged, especially those with disabilities, to ensure that no one is left behind. The union government policies to promote universal education and 'zero rejection' under *Sarv Shiksha Abhiyan* (SSA), Inclusive Education for the Disabled at Secondary Stage (IEDSS) and *Rashtriya Madhyamik Shiksha Abhiyan* (RMSA) are certainly positive steps in improving the quality of education for students with visual impairments in inclusive set up at schools. Currently, many of the students are unable to pursue subjects like Geography after Class X because of lack of good diagrams and maps explaining concepts. Introduction of cost-effective tactile map book may create a noticeable improvement in the quality of education. It will also promote the demand for tactile maps and graphics in all subjects from primary to higher secondary stages of school education. The enthusiasm

and eagerness among students with visual impairments towards education make us believe that these children can get just as much out of learning about the environment, different places as a sighted person, so it is important that all investments — current and new — should be screened against a key criterion: do they help in ensuring that all people, including the most marginalised and vulnerable, acquire the knowledge, attitudes and skills they need for their lives and livelihoods and for the full realisation of their right to education? (UNESCO 2015). All students may be fully included and encouraged in mapping skills through Geography education in schools, and teachers can make a major contribution to the improvement of student-learning outcomes.

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