Chapter 7

Findings, Suggestions and Conclusion
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“Somewhere, something incredible is waiting to be known.”
- Dr Carl Sagan

7.1 Introduction

Major findings which have been identified on the basis of the analysis of data collected from the promoters of science, digital library experts, science teachers and school librarians have been listed in this chapter. The acceptance of the hypothesis has been examined. These findings support strongly the design and development of the Children’s National Science Digital Library for India (CNSDLI) to promote science education.

7.2 Policy Makers & Promoters of Science Education

This section presents the inferences, which are made after the interviews and discussion along with the analysis of questionnaires received from the promoters of science education, coupled with literature review.

7.2.1 Policy makers, science promoters, decision takers in the matter of science education are aware of the fact that majority of the parents and children are hesitant to opt for science education due to the lack of awareness of career opportunities and sufficient propagation of career opportunities due to science education.

7.2.2 Medium of education in regional languages at the primary and secondary level is a cause for concern among the promoters of science, and which may is one of the reasons for lack of awareness
about various projects and schemes of the government for students to pursue science education.

7.2.3 Lack of efforts on the part of teachers and parents in instilling the curiosity and excitement in children towards science has partly resulted in students not pursuing pure sciences as a career option.

7.2.4 It is common consensus that today’s generation are digital natives and this connect can be exploited to guide the students to develop passion for science subject.

7.2.5 Free access to books, lectures, videos will benefit the rural students and thus the development of CNSDLI will be of immense benefit to the students living in villages.

7.2.6 ICT invasion in most of the classrooms has resulted in easing the teachers’ teaching work and made way for new teaching aids and pedagogy to be implemented for better absorption of the concepts taught.

7.2.7 It has been a common concern among all the promoters that children’s problem solving and collaborative skills need to be enhanced in order to help them succeed in science education.

7.2.8 The digitizing technology has revolutionized the publishing industry in India and if education field is able to cash in on this and promote the use of digital resources, there will be greater interest among teachers and students in teaching and learning process.

7.2.9 Simplicity and user friendliness is stressed upon by most of the respondents in the context of the development of proposed Children’s National Science Digital Library for India (CNSDLI).
7.2.10 All the facilities and services that are available in any subject specialized digital library are suggested for inclusion in the proposed CNSDLI. Prominent among them are career counseling, chat reference, literature alert system, etc.

7.2.11 Inclusion of regional language learning resources in the proposed CNSDLI will enhance the learning ability of the students to a larger extent.

7.2.12 It remains to investigate as to why the projects and the organizations which are supposed to promote science education among school children have not been seriously considered by the concerned organizations for hosting the proposed project plan.

7.2.13 It’s disheartening to note that some of the respondents approached were the people who were at the helm of affairs and have chosen not to respond to the questionnaire and thus it reflects the callous attitude of the decision makers in encouraging new projects and ideas in promoting science education.

7.3 Digital Library Experts

In chapter 5 it has been explained that a separate questionnaire was distributed to digital library experts to express their opinion on the perspective of designing and developing the Children's National Science Digital Library for India. The findings after the analysis of the questionnaires are presented below:

7.3.1 It was a clear affirmation that school libraries play a greater and important role in promoting science education.
7.3.2 The digital library experts have suggested that the school librarians should upgrade their performance to suit the changing digital environment in the information landscape.

7.3.3 It was clear from the survey that there is no exclusive effort to develop a children’s digital library for science subjects at the national level in India.

7.3.4 It was found that one of the main reasons is poor funding and inadequate network facilities in schools.

7.3.5 It was a common suggestion that the government should extend technological support to the schools to create the new digital library environment.

7.3.6 Digital library experts have unanimously agreed that the school librarians play a vital role in selecting, organizing the current and authentic digital resources in a structured manner.

7.3.7 Skilled manpower, strong government support in the form of finance, ICT infrastructure, digital information resources, imaginative interfaces, customization of open source software platform, large storage capacity and strategies for attracting publicity to divert the young minds towards science subject have been suggested as essential aspects.

7.3.8 It is appreciated by all that establishment of science digital library at the national level would be valuable in its role as a single access point for the science learners and teachers in schools, all over India.
7.3.9 The common suggestion is the formulation of appropriate guidelines, standards, training programmes, suitable mechanism of searching and retrieval resulting in the success of Children’s National Science Digital Library for India (CNSDLI).

7.3.10 Suggestion of various software tools and standards to be used reveals the fact that almost all are aware of them, but the stress is on the easy brows-ability and search facility.

7.3.11 Whatever may be the format and type of the web based sources selected, it should be amenable for change suiting to the needs of changing technology.

7.3.12 Centralized model is the preferred choice of the experts for creating and developing collection into proposed Children’s National Science Digital Library for India (CNSDLI).

7.3.13 All the initiatives taken by the government to attract the students towards science subject have been suggested by the experts to be included as additional features in the proposed Children’s National Science Digital Library for India (CNSDLI).

7.3.14 In spite of the lukewarm response to the government initiatives to promote science education, many suggest that the government should be involved in promoting the proposed Children’s National Science Digital Library for India (CNSDLI).

7.3.15 Another worthy suggestion is the bottom to top approach to promote the proposed Children’s National Science Digital Library for India (CNSDLI).
7.3.16 National Informatics Centre (NIC), National Mission on Education (NME), Consortium for Educational Communication (CEC) and National Mission on Libraries (NML) are some of the capable organizations to initiate and host the project of this stature and to monitor successfully.

7.4 Science Teachers

7.4.1 Practical and application based learning is very low in Indian school education as the teaching is concentrated on textbooks alone in most of the schools.

7.4.2 Government of India has initiated many programmes, projects, drives, etc but their implementation is only in cluster of cities or towns or districts. These initiatives have not percolated to the grass root level, especially to the rural schools from where half of the talented students come.

7.4.3 Most of the government initiatives have been unable to make a mark due to lack of proper monitoring and popularizing them among science teachers who can take it to their classrooms and motivate the students to pursue science education.

7.4.4 Irony is that all the science teachers are aware about and talk about process oriented teaching being more important than product oriented teaching, yet most of them are unable to translate their views in their day to day teaching.

7.4.5 It has been observed that most of the urban schools have easy access to technology and facilities to implement and use the
same in the schools. For example most of the schools have smart classes or are technology enabled where the textbook material is enhanced with pre designed modules available in the digital form to be taught using audio visual aids. Yet, no concrete results emerge from such schools except for a couple of students. These students either compromise their passion for lack of facilities, motivation or support to carry further their research interests or move away to developed countries in search of better facilities.

7.4.6 Many non-profit organizations and a few industries have made genuine efforts to bring science education to the door step of the rural students in the form of science mobile laboratories, science fairs, science centers, etc. But how consistent they are in their efforts and how they are to be sustained is to be thought over.

7.4.7 Most of the science teachers are well versed in using the computer technology and are using power point presentations, video CDs, digital photographs, etc. effectively. But the content is downloaded from the web and most of these resources are intended for students of developed countries. No attempt is made to customize the contents to suit the Indian school environment.

7.4.8 Interestingly none of the respondents are aware of children’s digital libraries like NSDL which are exclusive portals for scholarly information on science and allied subjects. Neither have they mentioned any of the Indian institutions which have exclusive programmes for promoting science education at school level.
7.4.9 The science teachers’ efforts to enhance their teaching using technology are restricted to Google, Wikipedia, YouTube and a few websites suggested in the textbooks or educational boards like CBSE. Some of them depend on certain audio visual educational products developed by software developers like TATA, EDURITE, etc.

7.4.10 It is disheartening to note that there are no concerted efforts either by the government or any institution to provide access to Indian scholarly science material of use to students at school level except to some remote access to outdated tutorials.

7.4.11 The study resulted in proving that the teachers too would be extremely benefitted with the librarians’ effort to identify, organize and provide access to web based science resources in the form of a digital library and they were clear that it would boost the students’ interest and inclination towards science.

7.4.12 It was evident from the study that a children national science digital library for India would be favoured by Indian teachers as it would equip them with required information at finger tips.

7.4.13 Regarding the coverage of the collection, most teachers have expressed that apart from curriculum related resources, there should also be availability of subject stimulating activities like quizzes, puzzles, etc to draw the children towards science.

7.4.14 Easy accessibility is what all the teachers expected from the proposed Children’s National Science Digital Library for India and
stressed on getting the benefit of all the services that a traditional library offers.

7.4.15 The study pointed out that there is a serious need of creating awareness regarding the advancement of the technology application in the field of education. There is also a need to train all the teachers in using the technology to the optimum and give specific training in using various teaching pedagogies to impart science education. It should be done in a way that it appeals to the students who are digital natives and grasp more swiftly through digital media.

7.4.16 It is found that there is interest and inclination among some science teachers to update themselves and be better equipped to handle the 21st century tech savvy students. At the same time many of them are least interested in reading their specialized subject and are satisfied with the textbook alone. Reequipping with the latest knowledge in the areas of the subject they are supposed to teach is the need of the hour, rather than being satisfied with age old chalk and talk teaching method and other such teaching practices.

7.5 School Librarians

7.5.1 Identifying, organizing and providing access to web based science resources at the school level in India is important and useful according to school librarians in India.

7.5.2 Use of digital resources is witnessing a sharp rise in school libraries both by the students to learn and teachers to teach.
7.5.3 It is the need of the hour to have an exclusive Children National Science Digital Library for India (CNSDLI) due to children's inclination towards digital technology and also the spurt in science digital resources at the regional level.

7.5.4 The stress was on having as well as giving access to digital resources which are curriculum based and related to the topics that students enjoy studying and learning more about those topics.

7.5.5 It is interesting to note that creation of digital libraries is no longer the bastion of the top rung digital experts but now a lot of involvement of the students, inputs from teachers and librarians is sought and incorporated.

7.5.6 Also a few proactive school librarians have made attempts to create portals to provide access to freely available scholarly electronic resources on their school website.

7.5.7 Fairly useful resources are being developed in regional languages in India.

7.5.8 The study revealed that collection development policy is absolutely essential for the proposed Children's National Science Digital Library for India (CNSDLI).

7.5.9 The trend in most of the affluent school libraries appears to provide access to open access electronic information resources available free on the Web and hardly any genuine interest is shown to subscribe any paid electronic databases.

7.5.10 Traditional classification and cataloguing systems are still the most preferred systems for organizing the web based resources.
DDC is the choice for classification and AACR2 is chosen by most for cataloguing.

7.5.11 It was observed that there is no in-depth understanding about the creation of digital libraries as most of the school librarians confused software tools to create and manage the web based resources with library automation software.

7.5.12 Virtual Reference Service and expert service are quite popular among the school librarians to be added as additional services.

7.5.13 Orientation programmes and workshops are the most sought after option for promoting the digital library organization and services.

7.5.14 Money, manpower and the mindset for embracing the digital environment are the major concerns expressed throughout the study to successfully launch the Children's National Science Digital Library for India (CNSDLI).

7.5.15 It is evident from the study that school librarians are strongly in favour of creating a facility for using the Web Based Resources that will benefit the teachers and students for their teaching and learning process.

7.5.16 The study indicated that government or government run institutions involvement in CNSDLI, become significant in providing new dimension to the science education in schools.
7.6 Suggestions:

Keeping in view the findings of the study a close interaction with the selected available samples revealed some of the easily feasible suggestions. Many of the suggestions are also supported by the studies that have taken place here and there. An attempt is made here to put together all possible and implementable suggestions to consider the proposal of CNSDLI and to initiate its establishment by the appropriate authority.

7.6.1 There is a dire need for a national policy and to monitor the same, a national task force is to be established in order to rejuvenate the school libraries in the knowledge society.

7.6.2 The recommendations of the NKC to be considered in true spirit to develop a mechanism for revamping the school libraries and to support the induction of adequate technological facilities to explore the proliferating digital information resources for effective teaching and learning.

7.6.3 Establishment of National Research and Development Organization for successful functioning and regulating the activities of the proposed Children’s National Science Digital Library for India (CNSDLI).

7.6.4 Competent organization with well established infrastructure like INFLIBNET, NCERT, CEC can be entrusted with the task of training the teachers to access and use the digital library for a defined purpose and to regularly update their skills. CEC with its well organized AVRC and EMMRC be
involved in designing and developing the digital information resources for different levels of education.

7.6.5 EDUSAT facility must be explored to organize the educational programmes by linking to the proposed Children’s National Science Digital Library for India.

7.6.6 A national level high power committee consisting experts from communication technology, networking technology, media, education policy formulators and educational administrators including teachers from different subject fields be constituted to build strong partnership among the related institutions and organizations.

7.6.7 Governments both at the central and state level be committed to extend all the infrastructural facilities to popularize the virtual programmes right from kindergarten to class twelfth level on the lines of facilities extended to schools like midday meals, laptops, Internet connection and other essential incentives.

7.6.8 In order to look after the complexities of copyright, IPR and DRM, an expert committee be formed selecting the experts from the concerned fields to monitor the fair use of digital resources.

7.6.9 Digital information literacy programmes be organized from local, regional and national levels to empower the users at different levels of education.
7.6.10 National mission on libraries has to be re-aligned by allocating responsibilities of monitoring and guiding school libraries, academic libraries and public library to respective task forces.

7.6.11 Such task forces are to be given autonomy to organize and sponsor periodical conferences, seminars, workshops, training or empowerment programmes at regional, state and national level.

7.6.12 Proper mechanism be developed for organizing and indexing the science education products and services broadcasted/telecasted through the media from time to time.

7.6.13 A systematic index of the science educational products and products available from the social networks be prepared periodically and made available through the proposed Children’s National Science Digital Library for India.

7.7 Future Avenues in Research

Digital Libraries are fast emerging. There are several complex issues to be explored so as to exploit the advantages of the digital libraries for the healthy development of knowledge society in India. In all possible aspects, India is forging ahead to facilitate the establishment of digital libraries by providing adequate infrastructure. Being a fast developing knowledge super power, India needs the thorough study of digital libraries from different perspectives. Here are some of the critical issues which need to be given a serious attention to probe. This calls for strong support from the public and private sectors and also by the competent researchers.
representing the intensive subject areas. The following are the suggested areas to be considered for future research programmes.

- A comprehensive survey of digital libraries in India
- Use and user studies of digital libraries in India
- Security aspects in Digital libraries
- Digital Rights Management (DRM)
- Digital content creation and management for different academic levels
- Pricing models and policy studies
- Impact of digital technology on teaching and learning in school education
- Growth and development of educational digital products and services in India

7.8 Conclusion

The world is changing around us. There is further need to empower our students with all the benefits that updated technology can provide to make them ready for the future. Today education entrepreneurs have come up with a whole range of such solutions that provide unprecedented opportunities to enhance educational systems. The idea of ‘digital classrooms’ where education is delivered through digital platforms has caught the imagination of the education community. They pose as a good strategy for engaging the digital generation and improving individual learning opportunities. The benefits of IT tools and their integration with teaching and learning, helps students in managing their time well. Use of
such tools, help students to enhance their critical thinking skills and thereby adds value to their studies.

National Knowledge Network throws open tremendous possibilities for all solution providers in the education sector. The National Mission on Education through Information and Communication Technology (NME-ICT), National Programme for Technology Enabled Learning (NPTEL) and related IT activities of the government have all emphasized on the involvement of the private sector to address educational concerns.

Generally it is observed that any progressive country or institutions in that particular country embrace the changing information environment. Timely and strategically framed organizational transformation is a prerequisite for survival. Particularly in the context of a learning curriculum and co-curriculum based learning in the technology driven environment, digital resources are very much essential. Digital libraries are now in a position to provide seamless access and uninterrupted services suiting to the requirement of the users. Digital libraries have emerged as one of the significant component of global information environment. India is now realizing its potential and vitality and has initiated number of projects and programmes in this direction. Most of the developed and developing countries have greatly understood the features of digital libraries and are well set for creating the required infrastructure. Digital libraries facilitate the generation of local content; device mechanisms to provide instant services
to the users located in different places. They are in a position to fulfill the information needs of the users from anywhere, anytime and in any form.

In India, digital library initiatives have been seriously considered in some academic and research organizations. Central government and some state governments have shown interest in digitizing the official documents, land records, cartographic materials, policy documents, legal judgments, Loksabha and Rajya sabha debates. Somehow these initiatives lack cooperation and coordination. Many of the digital activities are still in the project stage and are yet to be practically implemented. There are several perennial problems regarding the preservation methods, copyright, training and management, content generation, content selection, consolidation and coordination. A national concerted effort to handle these problems is very much needed in the present context. In addition there are other aspects like digital rights management, IPR, pricing policies and security. Series of survey of the digital initiatives in the country has promoted the researcher to take up the research on the aspect of design and development of Children's National Science Digital Library for India (CNSDLI) and to propose the prototype model for the same.

Digital libraries developed for any national cause can work successfully when they are developed with a long range plan, good criteria for selection, establishing broad involvement in decisions and by using careful assessment and follow up action. There is a growing need for libraries to work cooperatively to mount the content that meets the local needs which is more important in a country like India. This effort will naturally support
the useful digital collection in the proposed Children’s National Science Digital Library for India.

Digital information resources exclusively for the school education are being produced by various organizations, institutions, publishing firms and academic associations. Networking technology has facilitated easy access to these resources irrespective of distance and time. Compared to the production of print resources, production of digital information resources is on increasing side. This indicates the influence of the digital media on the users particularly the younger generation. Gone are the days where the printed book was the predominant source of information, more so in the educational sector. This study is a modest attempt to assess the mood for a national science digital library for providing easy access to all sorts of digital materials suiting the requirements of the course curriculum particularly for K-12 level of education. Present research is just an experiment in designing a prototype of a national digital network for children to facilitate in promoting better learning and understanding of the science concepts. It is based on the various digital initiatives and the positive steps taken by the government towards building the ICT infrastructure and their induction in the school education.