# CHAPTER 2

## CONCEPTUAL BACKGROUND

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CHAPTER 2
CONCEPTUAL BACKGROUND

The present study, ‘Access to information for visually impaired students in Mumbai and Pune region’ lies within the discipline of library and information science (LIS); however, it is also linked to several concepts from other disciplines such as social sciences, health sciences and technology. The current chapter seeks to explain these concepts and demonstrate the significance and inter-relationship of these concepts with the study.

It is believed that with the help of technology, information or accessibility to information, for the disabled can be substantially improved to bring about a more socially inclusive society. The chapter begins by describing the concept of social and educational inclusion, disability with special reference to visual impairments, information availability and accessibility issues and concludes with describing the assistive technologies which bring about better information access.

2.1 INCLUSION

Inclusion is the act of including; the state of being included (Merriam – Webster, 2013). The term ‘inclusion’ is used in a variety of contexts, chiefly with reference to ‘social inclusion’ and ‘inclusive education’.

2.1.1 Social Inclusion

Social inclusion is defined as the provision of certain rights, such as employment, adequate housing, health care, education and training, etc to all individuals and groups in society (Collins Dictionary, 2013). In the 1980s, in response to the growing social divide that arose from new labour market conditions and the inadequacy of existing social welfare provisions (to meet the changing needs of more diverse population); the term ‘social exclusion’ emerged in Europe; although the phenomenon had long existed in several
societies, including India. Social exclusion and inclusion are often considered opposites of each other or social inclusion is seen as a reaction to social exclusion. Social inclusion is however, not just a response to exclusion.

Social inclusion is a normative (value based) concept. It is about ensuring that all citizens (children and adults) are able to participate as valued, respected and contributing members of society. Social inclusion is a sign of a proactive, human development approach to social wellbeing that calls for more than the removal of barriers or risks. It requires investments and action to bring about the conditions for inclusion. It is therefore more than eradicating barriers; it involves a broadened holistic approach to truly include the ‘outsiders’. Valued recognition, human development, involvement and engagement, proximity and material well being are considered as the cornerstones of social inclusion. (Saloojee, 2003)

Social inclusion of children is looked at more from the ‘inclusive education’ point of view for the obvious reason that education is the foundation of a child’s overall development which would enable him / her to lead a better quality of life. Education is often said to play a key role in determining how one spends one’s adult life – a higher level of education often translates into higher earnings, better health, and a longer life. (UNESCO, 2009)

2.1.2 Inclusive Education

According to UNESCO, inclusive education is seen as “a process of addressing and responding to the diversity of needs of all learners through increasing participation in learning, cultures and communities, and reducing exclusion from education and from within education.” (UNESCO-IBE) The UNESCO Convention against Discrimination in Education (1960) and other international human rights treaties prohibit any exclusion from or limitation to educational opportunities on the basis of socially ascribed or perceived differences, such as sex, ethnic origin, language, religion, nationality, social origin, economic condition, ability, etc. Education is not simply about making schools available for those who are already able to access them. It is about
being proactive in identifying the barriers and obstacles learners encounter in attempting to access opportunities for quality education, as well as in removing those barriers and obstacles that lead to exclusion. (UNESCO, 2012). UNESCO highlights looking at ‘education through an inclusive lens’ which implies a shift from seeing the child as the problem to seeing the education system as the problem. It emphasises reorienting teacher education, welcoming of diversity, greater involvement of parents and children, flexible teaching methods with innovative approaches to teaching aids and equipment as well as the use of information and communication technology.

Thus, inclusive education is a pairing of philosophy and pedagogical practices that allow each student to feel respected, confident and safe so he or she can learn and develop to his or her full potential. It is based on a system of values and beliefs centred on the best interests of the student, which promotes social cohesion, belonging, and active participation in learning, a complete school experience, and positive interactions with peers and others in the school community. (Government of New Brunswick, 2009)

2.1.3 Inclusion of People with Disabilities

Both social and educational inclusions include people with disabilities as well. In fact, very often social and educational inclusions are looked at only from the point of view of including people with disabilities. The Government of India has enacted laws, provided guidelines and policies that aid and ensure inclusion of people with disabilities in society as general and education as well. Some of the laws, policies and schemes related to inclusion of disabled children and education are:

- Integrated Education for Disabled Children (IEDC) Scheme implemented from 1974 to 1982
- National Policy on Education (NPE, 1986 - 92): The Indian Government formulated the National Policy on Education for all government schools and articulated a need to integrate students with disabilities.
• Project on Integrated Education for Disabled (PIED) in association with UNICEF in 1987

• District Primary Education Programme (DPEP), 1995

• The Persons with Disabilities Act (PWD Act, 1995): The PWD Act proposed the provision of improved educational services, medical care, vocational training, employment, and social security for all persons with disabilities.

• Janshala Programme, 1998 later replaced by Sarva Shiksha Abhiyan

• Sarva Shiksha Abhiyan (SSA), 2000 started as a comprehensive & integrated program to attain universalisation of elementary education and to achieve zero dropout rates by 2010.

For children with disabilities, as for all children, education is vital in itself but also instrumental for participating in employment and other areas of social activity. For children who are not disabled, contact with children with a disability in an inclusive setting can, over the longer term, increase familiarity and reduce prejudice. Inclusive education is thus central in promoting inclusive and equitable societies (WHO, 2011). Inclusive education of students with disability is possible by:

• Removing physical barriers posed by stairs, doorways, toilets, water faucets, and other architectural aspects imperative to accessing facilities in the school.

• Removing the barriers of the teaching system, by providing facilities for accessing information related to the curriculum, by the use of modern technology like computers using specialized software.

• Removing the barriers of the examination system by providing means of free and fair evaluation of the students’ knowledge irrespective of his/her sensory/physical status.

• By providing awareness, increasing sensitivity in teachers and removing the barriers of attitude. (Puri & Abraham, 2004)

Inclusive education of people with disabilities will contribute substantially towards bringing about their social inclusion.
2.2 DISABILITY

Until a few decades ago, ‘disability’ was not a commonly used term for people with impairment. They were addressed as ‘crippled’, ‘cursed’, ‘lame’, ‘retarded’ etc. In fact until the early 21st century, there have been a variety of definitions and approaches to describe disability and impairment. In 1976, the World Health Organization [WHO] drew on a three–fold distinction between impairment, disability, and handicap. The distinction was:

**Impairment** is any loss or abnormality of psychological, physiological, or anatomical structure or function.

**Disability** is any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being.

**Handicap** is a disadvantage, for a given individual, resulting from impairment or a disability, which prevents the fulfilment of a role that is considered normal (depending on age, sex and social and cultural factors), for that individual. (Walia, 2010)

Although the distinction drawn by WHO changed the focus from the unwanted terms towards activity and disadvantages of people with impairments; it did not encompass all aspects of disability. Later, the concept of disability was described with the help of two new approaches – medical and social approaches. According to the medical model / approach, disability is a result of physical impairment or trauma and needs treatment to be cured (Disabled World, 2010). The medical model promotes the notion that it is the individual disabled person who must adapt to the way in which society is constructed and organised and therefore is also known as the ‘individual model’. Organisations of disabled people vigorously reject the medical model, but it still saturates the attitudes of many towards disabled people and also underlies the self perception of many disabled people and their caregivers.
In contrast to the medical model, people with disabilities have themselves developed the social model of disability. This model explains that disability is caused by the society in which one lives and is not the ‘fault’ of an individual disabled person, or an inevitable consequence of one’s limitations. It is the product of the physical, organisational, and attitudinal barriers present within society, which lead to discrimination. A change of approach and thinking in the way in which society is organised is required to ensure the removal of discrimination. (The Open University, 2006)

In 2001, WHO officially endorsed the ‘International Classification of Functioning, Disability and Health’ [ICF] as the international standard to measure health and disability. It stated that every human being encounters and suffers decrement in health and physical well-being at some stage in life and thus experiences disability (WHO, 2013). ICF understands functioning and disability as a dynamic interaction between health conditions and contextual factors, both personal and environmental. Promoted as a “bio-psycho-social model,” it represents a workable compromise between medical and social models. In the ICF, problems with human functioning are categorized in three interconnected areas:

- **Impairments** are problems in body function or alterations in body structure – for example, paralysis, or blindness;
- **Activity limitations** are difficulties in executing activities – for example, walking or eating;
- **Participation restrictions** are problems with involvement in any area of life – for example, facing discrimination in employment or transportation.

**Disability** refers to difficulties encountered in any or all three areas of functioning (WHO, 2011)

These distinctions and descriptions are a reflection of the changing attitude of the society towards people with impairment and the issue of disability in general. Paul T. Jaeger emphasized that changes in societal attitudes are
reflected by the accepted terms used to describe people with disabilities. “The importance of language may be best understood by comparing the implications of using the term "disabled person" as opposed to "person with a disability."

The first term places the emphasis on the disability, whereas the second term places the emphasis on the person, which is frequently described as "person-first" terminology. The use of person-first terminology linguistically reinforces that the person is more than, and more important than, the disability. The general shift towards using more humane terms to describe the condition of having a disability has been fuelled by members of the disability community asserting their right to be treated as human beings” (Jaeger, 2005. p 4.)

The way in which a society defines disability is reflected in social attitudes and, more recently, in legal definitions of disability.

### 2.2.1 Prevalence of Disability

The gravity of issues of people with disability can be better understood if the number of people affected is known. Different countries collect disability statistics using different approaches, varied definitions of disability and its types, and diverse methods ranging from regular census and surveys at some intervals. The results therefore may or may not depict the actual picture and numbers. The WHO description which is the approach that considers disability as per functionality is the preferred one and is being used in many countries.

According to WHO report on disability, “there are more than 1000 million people with disabilities in the world, of whom between 110 million and 190 million experience significant difficulties. The total corresponds to about 15% of the world’s population. Furthermore, the prevalence of disability is growing because of ageing populations and the global increase in chronic health conditions. Disability disproportionately affects vulnerable populations, in particular, women, older people, and people that are poor. Low-income countries have a higher prevalence of disability than high-income countries.” (WHO, 2012, p 3)
In case of India, the prevalence statistics are available only from census 2001 and National Sample Survey 2002. (The Census 2011 data on disability is not released yet). There are some discrepancies due to the differences in the definitions of disability types and the methods of data collection. However, both estimates of disability are low (around 2 percent). Alternative estimates using better methods and definitions that are more inclusive suggest a higher incidence of disability (4-8 percent) in India. (The World Bank, 2007)

**Table 2.1: Comparative figures on Persons with Disabilities based on NSSO 2002 survey (58th round) and Census 2001** (Central Statistics Office, 2012)

<table>
<thead>
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<th>Type of Disability</th>
<th>NSSO,2002 (Lakh)</th>
<th>Census,2001 (Lakh)</th>
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<tr>
<td>Locomotor</td>
<td>106.34</td>
<td>61.05</td>
</tr>
<tr>
<td>Visual</td>
<td>28.26</td>
<td>106.35</td>
</tr>
<tr>
<td>Hearing</td>
<td>30.62</td>
<td>12.62</td>
</tr>
<tr>
<td>Speech</td>
<td>21.55</td>
<td>16.41</td>
</tr>
<tr>
<td>Mental</td>
<td>20.9</td>
<td>22.64</td>
</tr>
<tr>
<td>Total</td>
<td>207.73</td>
<td>219.07</td>
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### 2.2.2 Effects of Disability

As per the manual on disability statistics (2012), the main underlying causes of disability are malnutrition, diseases, congenital factors, accidents and violence, inadequate hygiene, landmine explosions, lack of access to a health care system, exposure to chemical substances and stresses most of which are preventable. (India. Central Statistics Office, 2012)

Both the world report on disability (WHO, 2011) and the Indian Government’s manual on disability statistics (India. Central Statistics Office, 2012) have identified the effects and relations with some factors that are determinants of the quality of life of people with impairments. Some of them are:
• **Poverty** – which can be both a cause and effect of disability (India. Central Statistics Office, 2012)

• **Lower Educational Attainment** – exclusion from mainstream education opportunities lead to detrimental personal well-being and welfare resulting in a high social and economic cost to the nation. Disabled people have much lower educational attainment rates, with an average of 52% illiteracy against 35% for the general population. (The World Bank, 2007). Countries cannot achieve ‘Education for All’ or the ‘Millennium Development Goal’ of universal completion of primary education without ensuring access to education for children with disabilities

• **Low Employment and Livelihood** - both in developed and developing countries, working age persons with disabilities experience significantly lower employment rates and much higher unemployment rates than persons without disabilities. (WHO, 2011) Similar to other developing countries, in India as compared to the general population, people with disabilities (PWD) have lower employment rates irrespective of gender and location. The PWD employment rate in India fell from 42.7% in 1991 to 37.6% in 2002. (The World Bank, 2007)

• **Poor Health Care, Rehabilitation, Assistance, and Support** - assistance and support are prerequisites for participating in society and lack of these can lead to over dependence on family members.

### 2.2.3 International and National Legislation

To overcome the ill effects of disability and provide a strong international and national support to people with disabilities, international organisations like United Nations, WHO, Human Rights Education Associates etc have identified and proclaimed rights for people with disabilities. They have also formulated standards to ensure that people with disabilities obtain their rights; these standards can also act as guidelines for policy formulation at national levels.
The Convention on the Rights of Persons with Disabilities (CRPD) sets out international human rights standards for all persons with disabilities in the world. It views persons with disabilities as having legal rights and protects them from discrimination and requires that states, the private sector and others to take on the responsibility of respecting, protecting, and fulfilling those rights (United Nations Human Rights, 2013).

In India, the Ministry of Social Justice and Empowerment has provided specific legislations. The legislations include acts, regulations, and guidelines meant for welfare of people with disabilities and a Bill pending before the legislature.

- **Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995**
- **National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disability Act, 1999**
- **Rehabilitation Council of India Act, 1992**
- **The Rights of Persons with Disabilities Bill, 2012**

2.2.3.1 **Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995**

The Act gives effect to ESCAP’s proclamation on the full participation and equality of the persons with disabilities in the Asian & Pacific Region and provides for their education, employment, creation of barrier free environment, social security, etc. The implementation of the Act requires a multi-sectoral collaborative approach by the appropriate governments, including various Central Ministries / Departments, States / Union Territories and local bodies.
2.2.3.2 National Trust for Welfare of Persons with Autism, Cerebral Palsy, Mental Retardation and Multiple Disability Act, 1999

The Act provides for constitution of the Board of the National Trust, local level committees, accountability, and monitoring of the Trust. It has provisions for legal guardianship of the four mentioned categories of the persons with disabilities and for creation of enabling environment for as much of their independent living as possible.

2.2.3.3 Rehabilitation Council of India Act, 1992

The Act provides for constitution of the Rehabilitation Council of India for regulating the training of rehabilitation professionals, maintenance of a Central Rehabilitation Register, recognized rehabilitation qualifications, minimum standards of educations etc. (Ministry of Social Justice and Empowerment, 2009). Additionally, India is also a member of the CRPD and aims to follow the standards given.

2.2.3.4 The Rights of Persons with Disabilities Bill, 2012

This Bill, which is currently before Parliament, focuses on special provisions for education, employment, early detection of disabilities, launching schemes for providing aids and equipment, land resources for serving people with disabilities and non-discrimination in access. The non-discrimination in access section states “Appropriate governments and establishments shall ensure that the all persons with disabilities have the right on an equal basis with others to the physical environment, transportation, information and communications, including appropriate technologies and systems, and other facilities and services open or provided to the public, both in urban and in rural areas (The World Bank, 2007; Ministry of Social Justice and Empowerment, 2012)
2.2.4 Visual Impairment

Among people with disabilities, people with visual impairment are more dependent for almost all their activities and therefore, more attention towards their education, development and participation is essential.

Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995 defines visual impairment as a condition where a person suffers from any of the following conditions, namely,

1. Total absence of sight; or visual acuity not exceeding 6/60 or 20/200 (Snellen) in the better eye with best correcting lenses; or Limitation of field of vision subtending an angle of 20 degree or worse;
2. Low Vision: - Persons with low vision means a person with an impairment of vision of less than 6/18 to 6/60 with best correction in the better eye or impairment of field in any one of the following categories:-
   i. Reduction of fields less than 50 degrees
   ii. Heminaopia with macular involvement
   iii. Altitudinal defect involving lower fields (Ministry of Social Justice and Empowerment, 2011)

In addition to the medical definitions of disability and visual impairment, George Kerscher coined the term "print disabled" (around 1988-1989) to describe persons who could not access print. There is no common definition of the term ‘print disability’ in law; however, commonly used definitions include:

“A person who cannot effectively read print because of a visual, physical, perceptual, developmental, cognitive, or learning disability” (Reading Rights Coalition, 2013) and includes any natural person who:

- is blind; or
- has an impairment of visual function that cannot be improved by the use of corrective lenses to a level normally acceptable for reading without a special level or kind of light; or
• is unable, through physical disability, to focus or move his or her eyes to an extent acceptable for reading; or
• is dyslexic; and whose disability results in an inability to read a commercially available standard edition of a work; and who can be helped to read if the content is reformatted (but, to avoid doubt, requires only a change in the graphic presentation of the original text and not that the text itself be rewritten in simpler terms to facilitate comprehension)” (WIPO Vision IP, 2010).

2.2.4.1 Prevalence of Visual Impairment

The estimated number of people with visually impairment in the world is 285 million, 39 million blind, and 246 million having low vision.

**Figure 2.1: Number of people visually impaired, with low vision and blind per million population in the six WHO Regions and in India and China separately** (The World Bank, 2007)

*SEAR-India = South East Asia Region minus India, WPR-China = Western Pacific Region minus China.*
2.2.4.2 Impact of Visual Impairment on General Life

People with visual impairment, especially with severe visual impairment, stumble upon problems in almost all aspects of life. They need to adjust to their situation physically and psychologically. People who have lost their sight later in life face more difficulties in adjusting. Some of the major areas where impacts are observed are:

- **Loss of Self-Esteem and Personal Independence**

- **Loss of Confidence in the Remaining Senses** - In the absence of vision, a person needs to learn to depend and trust his other senses. It is often stated that people who lose one sense have extra ordinary strength in their other senses. This belief however, is untrue and requires increased concentration and training to depend on other senses.

- **Loss of Reality Contact with the Environment** - Sight plays the primary role in maintaining orientation. When sight is lost, individuals can lose a sense of where they are, and of who or what is around them. A feeling of “separateness” and a sense of isolation also occurs because the brain is receiving less stimulation.

- **Loss of Basic Skills** - They are without a sense of freedom, security, and control in their environment and feel very dependent on others (Loss of mobility). The performance of daily tasks leads to repeated frustration. (Loss of techniques of daily living)

- **Loss in Communication** - Following vision loss, individuals lose their ease of access to reading and writing. People, who have no vision since birth, have to undergo special training to enable communication via reading and writing. Additionally, gestures and facial expressions are important aspects of spoken communication. For a person with visual impairment or vision loss, it is extremely difficult to understand if a new person has entered an ongoing conversation or if a person has left. It also makes it difficult to analyse the expressions of a person to understand the meaning behind the conversation and the silences in a conversation.
• Loss of Employment and Financial Stability
• Loss of Social Activity and Participation

2.3 INFORMATION AVAILABILITY AND ACCESSIBILITY

The term ‘available’ is defined as present or ready for immediate use. (Merriam – Webster, 2013). Etymologically, ‘available’ also means "at one's disposal, capable of being made use of” (Harper, 2013), whereas ‘availability’ is defined as the quality or state of being available.

With reference to information, the phrase ‘information availability’ is used differently in different contexts and subject areas. For example, in the context of information technology and security, information availability (IA) refers to the ability of the infrastructure to function according to business expectations during its specified time of operation. Information availability ensures that people (employees, customers, suppliers, and partners) can access information whenever they need it and is defined with the help of reliability, accessibility, and timeliness. (EMC Publishing Company, 2010). In the context of library and information science, information availability is not well defined. However, it is usually considered as the existence or presence of information (in a documented form in library or other places from where it can be procured) which can be delivered to the user who needs it.

The term ‘access’ is defined as permission, liberty, or ability to enter, approach, or pass to and from a place or to approach or communicate with a person or thing and also the freedom or ability to obtain or make use of something (Merriam – Webster). Harrod’s glossary defines access as “a device or method whereby a document may be found” (Harrod’s Librarian’s Glossary and Reference Book, 1990)

Burnett and Jaeger (2005) define information access as “the presence of a robust system through which information is made available to citizens and others, with storage facilities ranging from physical libraries to digital
databases, yoked with mechanisms for finding specific types of information stored in such facilities”. This definition encompasses two areas, that of information technology and library and information science; suggesting the significance of combined efforts. It also indirectly indicates that one sided or one directional efforts may not be fruitful.

Information availability and accessibility are often used synonymously. However, availability of information does not mean accessibility, as sheer availability does not ensure accessibility. To access a piece of information, it is essential that the information is available. It is possible that the non clarity in definitions and the near-synonymous use of terms is due to the common purpose of both information availability and accessibility – information use (direct and indirect).

### 2.3.1 Facets of Information Access

‘Information access’ is a concept studied from a variety of approaches. It falls in the domain of informatics, computer science, information security and library and information science. Information access is said to be central and thus significant to all information related tasks, activities and researches comprising information needs, information seeking behaviour, information exchange, information use and information ethics as well. McCreadie and Rice (1998) suggested that information access depends on conceptualisations of ‘information’, conceptualisations of ‘access to information’ (from the viewpoints of knowledge, technology, communication, control, goods/commodities, and participation), facets of general information seeking process (context, situation, strategies, outcomes) and influences and constraints affecting the nature and extent of access to information (physical, cognitive, affective, economic, social and political). On similar lines, Burnett, Jaeger and Thompson (2008) identified three components of information access – physical, intellectual and social.
2.3.1.1 Physical Access

Physical access is generally viewed as “access to the documents” embodying information—literally the process of getting to the document that is being sought. Issues of physical access relate to the location and format of a document, and the conditions, technologies, or abilities required for reaching that document. Such issues are often readily identifiable and revolve around the questions of whether people can get into the location that houses the documents and then reach the specific documents that they seek. Physical access to information is primarily an institutional issue, depending on formalized structures that exist to ensure the information is located somewhere and is theoretically available. At the individual level, to achieve physical access the user has to know that the information exists, where it can be found, and how to navigate the institutional structures to reach it. Individual factors that can affect physical access include technology, economics, geography, and disability. (Burnett, Jaeger and Thompson, 2008)

2.3.1.2 Intellectual Access

Intellectual access can be defined as “access to information” contained in a document. It revolves around the ability to understand how to get to and, in particular, how to understand the information itself once it has been physically obtained. Intellectual access to information includes how the information is categorized, organized, displayed, and represented. Factors that can affect intellectual access can include information seeking behaviours, language, dialect, education, literacy, technological literacy, cognitive ability, vocabulary, and subjective views. Intellectual access to information for persons with disabilities, at a more conceptual level, entails equal opportunity to understand intellectual content and pathways to that content. (Burnett, Jaeger and Thompson, 2008)
2.3.1.3 Social Access

Social access is described with the help of the normative theory and the ‘small world’ concept. The ‘small world’, refers to a relatively small but incredibly influential, group of people that comprises of its own social norms, shared worldview, social types, and information behaviours. Social norms, worldview, and social types influence what information is seen to be permissible for members of a small world to access, and what kinds of information from the outside world will be perceived as acceptable within a specific small world. The normative theory posits that, within specific social contexts, information behaviours — like other day-to-day activities — must be seen as normative. The theory further suggests that the value of information is not universal, but is rooted within the norms and attitudes of a particular social world. Although the normative theory does not address questions of information access directly; however, its four concepts — social norms, worldview, social types, and information behaviour — define a set of social factors that directly influence individuals’ approach to, understanding of, and use of information (Burnett, Jaeger and Thompson, 2008).

McCreadie & Rice’s preliminary framework for understanding information access and Burnett, Jaeger and Thompson’s components of information access have many similarities. Both the approaches together, aid in better understanding ‘information access.’ Oltmann (2009) attempted to explain these two approaches together stating their similarities and relations in order to provide a comprehensive understanding of information access based on the two approaches. These approaches offer a helpful insight for understanding information access, but they do not exactly comply with each other. The three components (physical, intellectual and social) weaved with the six approaches to information access are depicted in the Figure 2.1
The explanations provided by McCreadie and Rice, Burnett, Jaeger and Thompson and also the one by Oltmann clearly indicate that social, intellectual and physical access are interdependent and cannot be studied alone if an comprehensive understanding of information access is required. These descriptions also indicate that there are six key factors (fitting in to the three components) that are responsible for information access.

However, it should be noticed that the interdependence of the three components is in a particular order and in succession. Social access is the foundation of information access, since it includes access as a fundamental right in addition to social norms, worldview, social types, and information behaviour. Without these sub sets of social access, a person would not be in a position to seek access to information. Only when the social access is in place, can a person strive and gain for physical access. It is but natural that intellectual access is not possible unless information is physically reached and accessed. This sequence of components of information access is depicted in the Figure 2.3.
2.3.2 Factors Affecting Information Access

Michael Buckland has identified similar aspects of information access. They have been suggested as barriers that need to be overcome in order to access information. The barriers are:

- **Identification**: A suitable source needs to be identified. This indicative access is the realm of bibliography, documentation, classification, indexing, and of information retrieval.

- **Availability**: The physical access, or document delivery, is a matter of logistics and technology. If a source that has been identified cannot be located and made physically available in an acceptable fashion, then another source needs to be identified and made available.

- **Price to the user**: The price may include, but is not restricted to, money. The real price of everything, what everything really costs to the man who wants to acquire it, is the toil and trouble of acquiring it. The "real price" includes time, effort, and discomfort.

- **Cost to the provider**: Not all expenditure of money and effort is borne by the inquirer, least of all in archive and library services which are traditionally free, in the sense that monetary charges are not usually
made. In this context we use the term cost to denote what has to be expended by the providers of service. To the extent that the sponsors or providers of service may incur expenditure of effort, money, space, or inconvenience, the arrangement would have be acceptable to or, at least, not incompatible with their view of their role, mission, and values.

- **Cognitive Access**: Once physical access to a suitable source has been achieved, another condition for successful access is that the inquirer has sufficient expertise to understand it.

- **Acceptability**: Acceptability denotes two related issues: First, inquirers may be reluctant to accept a particular source as credible, regarding it with suspicion as having inadequate "cognitive authority". Second, the inquirer may be unwilling to accept the evidence of the source because it is unwelcome in what it signifies and conflicts with other beliefs, a matter of cognitive dissonance. (Buckland, 1991)

### 2.3.3 Information Accessibility

Understanding the aspects of information access helps to realise that ‘accessibility’ is a step before access. The term accessibility is derived from the word ‘access’, i.e. it is the ability to access and thus is often seen as the prerequisite to access. Information accessibility encompasses the many issues surrounding availability, accessibility and affordability of information, such as multilingualism, metadata, and interoperability; open source software, open content, Creative Commons licences as well as addressing the special needs of people with disabilities. (UNESCO, 2012)

The relation between information availability, information access and information accessibility is described by Leah Lievrouw in the model of ‘information environment’. Lievrouw notes that information must be generally available before an individual can become personally aware of that availability. Yet mere availability is not sufficient for access. The personal (awareness of) availability is converted into accessibility through individual
capacity such as literacy and social intelligence. Finally, access occurs through individual action. She further notes, “Access can be ensured only if members of a community have also developed sufficient individual capacity to convert availability to accessibility, and subsequently to obtain access.”

**Figure 2.4: Model of Information Environment (Lievrouw, 2000)**

This model illuminates the micro-stages of information access and illustrates the physical, intellectual, and social elements necessary for people to access information (Oltmann, 2009).
It is thus clear that information availability, access and accessibility are interdependent and are extremely significant for a satisfactory personal and social life.

### 2.4 DISABILITIES, INFORMATION ACCESS AND INCLUSION

Information plays a major role in bringing about social inclusion. Social inclusion is based largely on equal participation which in turn depends on a fair understanding of issues in day to day life, societal issues and informed decisions. To participate equally in society, an individual needs information on a continuing basis. In order to enable equal participation, effective information practices that make available everyday and nuanced information that constitute elements of the information landscape need to be accessed and understood (Kennan, Lloyd, Qayyum, & Thompson, 2011). Access to information is also a key element at different levels of education, since educational inclusion entirely depends on participatory learning and social cohesion.

**Figure 2.5: Relation between Information and Inclusion**
Inclusion of people with disabilities therefore largely (directly and indirectly) depends on the status and quality of the information they access or is made accessible to them, and the ease with which they are able to put it in use. Without information a social being can neither function efficiently nor make decisions and participate in the society. Learning and social cohesion depends on information and access to information. Thus information and access to information is core to educational inclusion and social inclusion as well since only ‘information inclusion’ can lead to both.

2.4.1 Information Access for People with Visual Impairment

The lack of information access in the life of an individual with visual impairment has a great restrictive impact. All activities and decisions are affected since they are directly or indirectly based on information. This in turn greatly restricts the learning, education, and communication processes of a person with visual impairment leading to ‘information exclusion’ and eventually to ‘social exclusion’.

Overall, people with visual impairment can acquire and access information easily only from audio sources (cassettes, CDs, television, radio, and people) while, the other key resources of print, digital and non-verbal information are difficult to access. People with visual impairment, therefore, have to use alternative approaches to access information. Widely used alternatives are the audio and the tactile mediums. This implies that information should be converted to one of the accessible formats.

2.4.1.1 Audio Approach

Accessing information through the audio medium requires conversion of print and electronic information in to audio form. Converting print to audio can be done with human help or through a mechanical device. In both cases it can be used immediately or stored for later use.

- Individuals - Seeking help from other individuals to read the print aloud is a common practice. This however, is a temporary, ineffective
and inefficient method as the people willing to provide such kind of assistance may not always be readily available. The information read out cannot be repeated multiple times and thus may not help in educational or learning purposes.

- **Recording** - The information read out by individuals can be recorded on cassettes or CDs. However, these ‘audio books’ are analogue and do not offer book navigation facilities. The Digital Talking books, (Daisy format) are standardised approaches with navigation facilities.
- **Using assistive devices to read aloud text and thus convert print and digital information into audio format.** This has the possibility of being recorded as well.

### 2.4.1.2 Tactile approach

Another approach is to convert text which can be read by the human eye into text that can be ‘read’ through touch. This approach had developed over several centuries. In the fourteenth century, a blind Syrian professor named Zain-Din al Amidi improvised a tactile method by which he identified his books and made notes. In 1517, Francisco Lucas of Saragossa used a set of thin wooden tablets with letters carved into them. In 1547, an Italian doctor named Girolamo Cardano suggested a system that somewhat resembled Braille. In 1676, an Italian Jesuit named Francesco Terzi created a type of cipher code based on dots enclosed in squares and other shapes. Terzi also advocated the use of a type of string alphabet, where knots were used to represent letters. In 1784, Frenchman Valentin Haüy founded the first school for the blind; the pupils were taught to read using ordinary type printed in relief (New World Encyclopaedia, 2013).

However, the era during 1810 to 1880 was the most significant since more tactile reading–writing systems were developed. Boston line type was developed by Samuel Gridley Howe, the founder of the New England School for the Blind (later Perkins School for the Blind) in Massachusetts during the period 1832-1835. Since at the time there was no reading medium for people
with blindness, Howe developed an embossed simplified angular roman alphabet without capitals, which he called Boston line type. New York Point, a system of writing for the blind was invented by William Bell Wait (1839–1916), a teacher in the New York Institute for the Education of the Blind. The system used one to four equidistant bases, each of one or two points (Cooper, Holly L, 2010). In the mid 1800’s, Dr. William Moon developed a code of raised shapes. It was found particularly suitable for those who lose their sight later in life, or for people who may have a less keen sense of touch. Moon characters are fairly large and over half the letters bear a strong resemblance to the print equivalents. (Moon Literacy, n.d)

**Figure 2.6: Moon Characters** (Moon literacy, 2012)

Braille was invented in Paris, France by Louis Braille in 1829. Louis Braille lost his sight at the age of three due to an eye injury. As a young boy at school, he became frustrated with the large and bulky raised letter alphabet used to learn reading and writing skills. Later in his life, a French artillery officer, Charles Barbier de la Serre, gave him the idea of reading by a tactile code. After many years of experimenting, Louis Braille developed a successful reading and writing system that today is used around the world. People
mistakenly consider Braille as a language. In fact, Braille is a code and there is a Braille code for every foreign language; including French, Spanish, Chinese, Arabic, and Hebrew. There are also Braille codes for mathematics, music, and computers.

2.4.1.2.1 *Braille System*

The basis of the Braille system is known as a Braille cell. The cell is comprised of six dots numbered in a specific order. Each dot or combination of dots represents a letter of the alphabet.

**Figure 2.7: The Braille Cell** (CNIB, 2013)

![The Braille Cell](image)

The Braille characters make up the letters of the alphabet, punctuation marks, numbers, and everything else you can write in print.

**Figure 2.8: Grade 1 Braille** (CNIB, 2013)

```
A B C D E
J K L M N
S T U V W
```
There are a number of different versions of Braille. Uncontracted or Grade 1 consists of the 26 standard letters of the alphabet and punctuation. It is used only by people who are learning to use Braille. Contracted or Grade 2 consists of the 26 standard letters of the alphabet, punctuation, and contractions. The contractions are employed to save space because a Braille page cannot fit as much text as a standard printed page. Books, signs in public places, menus, and most other Braille materials are written in Contracted Braille. Grade 3 is used mainly in personal letters, diaries, and notes, and also in literature to a limited extent. It is a kind of shorthand, with entire words shortened to a few letters. There is no official standard for this version of Braille.
Initially, Braille was written using a special slate and stylus and later using Braillers. Automatic Braille output is now possible with computers, using Braille Embossers and Refreshable Braille Display and inputs using Braille keyboards.

Although Braille has been an effective means of communication for people who are blind, and is the most widely used method for reading and writing; there are some disadvantages as well. Using Braille requires training and practice, Braille documents are bulky and voluminous, producing Braille documents requires special equipment and paper, which are expensive, and Braille requires an acute sense of touch. Some readers who have low finger sensitivity, such as those with diabetes may not learn and use Braille.
2.4.2 Impact of Digitisation

Today, almost all information is created in digital format. It has been estimated that well over 90% of information currently produced is created in a digital format; further it is anticipated that this percentage will increase substantially in the future. Simultaneously, much of the existing content currently available only in physical formats is also being digitized. (Varian, 2005) Further, the quantum of information and made available digitally using the internet is tremendous and ever increasing. Print information converted to digital information and ‘born’ digital information, can be accessed by people with visual impairment using assistive technologies. The Web has become a valuable information resource for people with disabilities. Unlike before, they can obtain any type of information by themselves from all over the world whenever they need it by accessing the Web using assistive technologies.

Digital text information is a visual medium. The use of digital technology as an intermediary step to convert text to audio or tactile format is possible. However, the very nature of digital information poses barriers for people with visual impairment even with the use of assistive technologies.

2.4.2.1 Barriers in Using Digital Information

Some of the characteristics of digital information inhibit its full use by visually impaired people. This includes the combination of ease of combining text, image and sound and the non linear structure. It is these characteristics which are used most often in web documents. The Web’s focus is on non linear structuring and sharing of documents that rely heavily on colour, graphics, motion pictures, audio and other dynamic elements rather than on a linear logical flow of information. To make the Web accessible to users with visual disabilities, there is a need to understand the relationship between visual disability and Web applications. (Baguma, Bommel, et al, 2007). A combination of factors in the areas of web design, the limitations of assistive technology and the limitations of the visually impaired person, gives rise to a number of problems. The main problems which blind users face are:
• Blind users often listen to the web pages using a screen reader
• Not all screen readers support image maps
• Colours are unusable
• Frames cannot be "seen" all at once. They must be visited separately, which can lead to disorientation.
• Images, photos, graphics are unusable. Users generally do not use a mouse
• Complex tables and graphs that are usually interpreted visually are unusable
• It may be difficult for users to tell where they are when listening to table cell contents
• Blind users do not use a mouse, they often jump from link to link using the ‘Tab’ key
• Users expect links to take them somewhere

The problems faced by people with low vision include:

• Text in graphics does not enlarge without special software, and looks pixilated when enlarged
• Screen magnifiers reduce the usable window size
• Users may set their own font and background colors

People suffering from colour blindness are often not able to distinguish between red and green. Information conveyed through colours is therefore inaccessible.

To overcome the barriers of web accessibility, many countries have developed guidelines to create web documents. The guidelines given by the World Wide Web Consortium – Web Accessibility Initiative (W3C – WAI) are accepted globally.
2.5 ASSISTIVE TECHNOLOGY DEVICES

People with impairment require assistance from family, friends, and colleagues. However, regular human assistance is not practically feasible and many times is inadequate too. They therefore additionally require assistance from various devices to enable them perform tasks independently (or with minimum human assistance) and efficiently. People with impairment depend greatly on assistive technology devices. The disability differs with the impairment as so does the assistive technology that could ‘assist’ in a variety of ways. People with visual impairment have to depend more on these devices due to the nature of their impairment. Assistive technology enables them to overcome barriers of disability to a great extent.

The term assistive technology is very self-explanatory. It means some technology or device that assists. Here, technology does not necessarily mean high technology; it may also be low technology or a non-technology device. When we use the phrase ‘technology that assists’, it implies that assistance is provided to somebody who needs it. According to the McGraw-Hill Concise Dictionary of Modern Medicine, assistive technology is defined as “A technology designed to improve the quality of life a person with disabilities and function in the most optimal possible fashion” (The Free Dictionary, 2013). The Individuals with Disabilities Education Act, 2004 (U.S. IDEA) defines assistive technology as “Any item, piece of equipment or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of children with disabilities”. (Georgia Department of Education). Assistive technology is a generic term used for a wide range of software and hardware designed for disabled people to assist with everyday tasks in both work and home life. They can be standalone products that serve specific discrete functions, products that provide access to other devices, particularly computers, or technologies that are built into mainstream products to enhance their accessibility. (Action for Blind People, 2013)
Assistive technology can be categorised based on their technology dependence as high technology, low technology and non-technology and/or based on the type of impairment they are most useful for. These are known as assistive technology for physical impairment, visual impairment, hearing impairment, learning disabilities etc. They are sometimes also differentiated as per the activity or area that they assist the user in; e.g. assistive technology for mobility, assistive technology for communication, education etc.

Although assistive devices are used for a variety of tasks, in a bigger context, all education related activities are directly or indirectly based on ‘information’ and ‘information access.’ As described in earlier section(s), a person acquires maximum through his senses, chiefly vision. It is therefore obvious that a person with visual impairment is at a greater disadvantage in accessing information. Devices that aid in mobility, daily activities like shopping for consumer goods etc are not covered in this section as they do not directly cater to information access.

Assistive technologies for visually impaired people (although the term assistive technology seems recent and sounds modern) have existed since a very long time. The only change; is in the variety of assistive technologies available today, their technology level, and the extent to which they help their users to access information and even perform difficult tasks which was earlier not possible with the low technology devices. For example, a magnifying glass did ‘assist’ people with low vision to read, but today, a CCTV or a video magnifier assists them better in reading.

Visually impaired people include people with low vision, colour blindness, and total absence of sight (blind). There are a variety of technologies that assist them in reading information in Braille, print and digital format and also write and communicate information in Braille, print and digital format.

There are multiple options that can convert print in to Braille and audio format. Depending on the user’s degree of disability, convenience, and
availability of devices, these conversions can be obtained; (Figure 2.11 will aid in understanding the process and options better). Assistive technology devices have become critical in the academic lives of visually impaired students by enabling access to previously inaccessible materials through the creation of adapted formats. These technologies also allow the students to access information on the internet, including the library catalogue, databases and other web material. This type of access is helpful in downloading full academic information thereby increasing the speed with which the students are able to use the information. This is an indication that the library web pages also must be designed in an accessible format and library terminals should be equipped with necessary assistive technology devices. (Saumure & Given, 2002)

Figure 2.11: Printed Document Access Challenge (Hersh, M. Johnson, M. p 557)
People with colour blindness face problems only in case of colour dependent information, e.g. maps, graphs etc. They usually depend on colour correction / support software.

People with low vision have some residual vision but suffer from some medical condition that affects vision in different ways. Depending on the severity of their problem, they depend on visual aids, audio aids or a combination of both.

People, who have no sight, i.e. are blind have a strong dependence on both audio and tactile aids, to access information.

**Figure 2.12 Assistive Technologies as per Disability**
2.5.1 Devices for Colour Blindness

People with colour blindness do not need to use many assistive devices as they are at a loss only in cases where information understanding is colour-dependent.

2.5.1.1 Colour guiding / Colour transform / Colour inversion Software


Software that transform colours of the computer display into the discriminable colours for various people including people with colour vision deficiency, commonly called colour blindness are available. In addition to distinguishing colours and finding a specific colour, they aim to help people with colour blindness:

- to guess a normal colour, and
- to feel the colour gradations in natural scenery etc. by their visual information.

2.5.2 Devices for Low Vision

People in this category have some residual vision left. The devices used usually enhance their vision or aid to overcome the vision defect. In case of greater vision loss or unavailability of these devices, they prefer using devices used by the blind.

2.5.2.1 Magnifiers

A magnifier (i.e. magnifying lens) is a lens or combination of lenses used to magnify (or enlarge) an object. Magnifiers and magnifying glasses enable people to magnify a variety of objects (e.g. books, newspapers, fine print, stamps, coins, antiques, art, jewellery, gemstones, foliage, insects, and rocks).
Roger Bacon invented the magnifying glass in 1250. Today, over 750 years later, magnifiers and magnifying glasses are more popular than ever, assisting people with hobbies and crafts and also helping people with low vision, macular degeneration or other vision conditions to see better. (Seeitbigger)

2.5.2.2 CCTV (Closed-circuit television)

A CCTV is a magnifying aid that consists of a camera and monitor, although a TV or computer screen may be used in place of the monitor. The magnification level is much greater than for a hand magnifier, and often combines a choice of foreground and background colours. Available in desktop or portable variations, some have a distance camera and thus may be used in a classroom, for instance. (Action for Blind)
2.5.2.3 Large Monitors

Computer screen technology has made significant advances in the last decade, with high definition flat screen technology increasingly replacing the previous technology of vacuum-tube-based computer monitors. This change in technology has been highly beneficial to visually impaired computer users, since it has significantly increased the clarity and definition of the screen output. (Hersh and Johnson, 2008)

2.5.2.4 Screen Magnification Software

A visually impaired person with residual vision can use a screen magnifier to access computer and information technology. A screen magnifier magnifies the screen using a small window containing an enlarged area of text. Generally, only part of the screen is enlarged at any one time. The window facility may be mobile, in which case it can be moved to a new text area rather like a magnifying glass.
The main difficulty with screen magnifier software is teaching the user how it works and how to recognise the working location on the screen.

2.5.2.5 Modified Keyboards

Keyboards with various high contrast colour combinations are available, including black letters on a yellow, white, or beige background, blue letters on a white background and bright yellow letters on a black background. The characters are large and bold, as well as both upper and lower case. These modified keyboards help people with low vision to input data with ease.

Figure 2.16: Modified Keyboard with Yellow Keys for Contrast (Image Shack)
2.5.3 Devices for Blindness

Visually impaired people depend greatly on audio and tactile information. They depend on these formats to receive information and also to provide inputs or send information. Audio format offers options from high tech to low tech devices. In the tactile format, Braille is the most commonly used medium of reading and writing by most visually impaired people. With advances in technology, the tactile approach to access information is incorporated into devices including both print and digital information. These devices save the time of the user and also aid in accessing updated information.

2.5.3.1 Tape / CD recorders

An audio tape recorder is an audio storage device that records and plays back sounds, including articulated voices, usually using magnetic tape, either wound on a reel or in a cassette, for storage. In its present day form, it records a fluctuating signal by moving the tape across a tape head that polarizes the magnetic domains in the tape in proportion to the audio signal. (Wikipedia, 2013)

Figure 2.17: Cassette Recorder with a Microphone (ebayimg)
Hand-held recording devices with voice-activated technology allow users to record material from any external source to a CD. These recorders capture sounds via an external microphone, and this input is then captured on the CD (McKinney, 2013). These voice-recording techniques are usually used for classroom note taking. Pre recorded cassettes in CDs are used in the areas of class notes, music, and books read out by volunteers.

### 2.5.3.2 Speech to Text Software

Speech-to-text conversion is the process of converting spoken words into written texts. This process is also often called speech recognition. Although these two terms are almost synonymous, Speech recognition is sometimes used to describe the wider process of extracting meaning from speech, i.e. speech understanding.

**Figure 2.19: Speech Recognition Software** (Special Education Technology British Columbia)
Like any other pattern recognition technology, speech recognition cannot be error free. The speech transcript accuracy is highly dependent on the speaker, the style of speech, and the environmental conditions. (VoxSigma)

2.5.3.3 Digital Talking Books

A traditional talking book is an analogue representation of a print publication. A Digital Talking Book (DTB) is a multimedia representation of a print publication. The analogue talking book had issues like access to different sections within a book, sound quality. The possible solution of a digital talking book was not a complete one. A digital talking book has a digitally produced human voice and does not resolve all of the issues, particularly the issues of accessibility and navigation from point to point within a book.

The DAISY DTB is a collection of digital files (from this point onward referred to simply as "files") that provides an accessible representation of the printed book for individuals who are blind, visually-impaired, or print-disabled. These files may contain digital audio recordings of human or synthetic speech, marked up text, and a range of machine-readable files.

The structure of the book is designated by the XML tags and is accessible to the reader by use of a browser or a playback device. The DAISY DTB utilizes the technology of the Internet with some specialized applications added to provide greatly improved access to the information.
Figure 2.20: Digital Talking Book with Player (National Library Service for the Blind and Physically Handicapped (NLS), 2013)

A computerized text DAISY book can be:

- Read using refreshable Braille display or screen reading software
- Printed as Braille book on paper
- Converted to a talking book using synthesized voice
- Printed on paper as large print book
- Read as large print text on computer screen (http://www.daisy.org/daisy-technology)

2.5.3.4 Text to Speech Software + OCR Scanner (Reading Systems)

Reading systems are designed for use by people with disabilities. They use Optical Character Recognition (OCR) to provide the printed word in accessible form.
There are three main elements of a reading system: the scanner, the OCR system and the accessible presentation. The majority of reading systems are built on a standard personal computer, where the user is likely to also have the use of a screen reader or screen magnifier for other tasks. In addition, there are stand-alone reading systems, which bundle all of the components into a single purpose unit that reads; the user is shielded from computer capabilities of the device. The functioning of the device is the same, but the complexity is hidden to make the device less intimidating. Text-to-speech (TTS) is the most widely used technology for providing access to printed information with reading systems.

Users who are not very skilled using a PC can often use these reading systems because they can be effectively operated with a couple of keys. As an alternative to PC-based systems, standalone version of their reading systems are also available.

2.5.3.5 Screen Reading Software

Screen readers are software products that support print disabled people, including blind and visually impaired and dyslexic people, by reading out the
text on the screen and outputting it to the user via a speech synthesiser or a Braille display.

**Figure 2.22: JAWS: A Widely Used Screen Reading Software** (Support 4 Sight)

There are a number of different screen readers available with different features. As each screen of new information is presented, the screen reader only outputs the part of the screen which is active. If information has been generated by a third party, then the format has to be readable. In the case of website pages, there are a number of guidelines for accessible page design. If text is embedded within a table then the user will be informed that the information is contained within a table.

Most screen readers are American in origin and the speech output from the speech synthesiser often has a pronounced American twang. Furthermore, current technology in speech synthesis can sound very artificial and unnatural. This may present difficulties for non-American users and particularly for users with any degree of hearing impairment.

### 2.5.3.6 Manual Brasillers

Brailler is a "Braille typewriter" with a key corresponding to each of the six dots of the Braille code, a space key, a backspace key, and a line space key.
Like a manual typewriter, it has two side knobs to advance paper through the machine and a carriage return lever above the keys. The rollers that hold and advance the paper have grooves designed to avoid crushing the raised dots the Brailler creates.

Figure 2.23: Perkins Brailler (The Future of Things, 2011)

The Brailler was designed and developed at the Perkins School for Blind in 1951 and hence is known as Perkins Brailler.

Figure 2.24: Perkins Smart Brailler (Dexigner, 2013)

The smart Brailler uses audio feedback and a digital display for both sighted and blind individuals to communicate, teach, and learn Braille together. Teachers in a mainstream classroom can see what their students are Brailling through the digital display. Students can take the lead in their own Braille education, as the audio feedback speaks the letters they enter into the Brailler. (Wikipedia, 2013)
The Mountbatten Brailler is an electronic machine used to write Braille. The Mountbatten incorporates the traditional "Braille typewriter keyboard" of the Perkins Brailler with modern technology, giving it a number of additional features such as word processing, audio feedback and embossing. (Digplanet, 2013)

**Figure 2.25: Mountbatten Brailler** (Quantum, 2012)

2.5.3.7 Modified Keyboards

Standard keyboards can be modified by stick-on key tops, which are sets of high visibility letter, number and function keys. The characters are large and bold, as well as both upper and lower case. The key tops sometimes also have Braille embossing. (Hersh and Johnson, 2008)

Braille users may prefer to use a Braille keyboard. Fluent Braille users are likely to have little difficulty in learning to touch type, which would give them access to a standard keyboard. However, they will still require some form of audio or tactile feedback to avoid errors. Braille computer input devices are not very readily available, probably because the size of the potential market is considered too small and decreasing.
Figure 2.26: Keyboard with Braille Embossed Key Tops (Braille: Literacy for the Blind, 2009)

The simplest approach to producing a Braille keyboard involves converting a standard keyboard using stick-on transparent Braille embossed key tops. This is the simplest and cheapest method. It has the advantage of providing the user feedback on the keys pressed, but requires touch typing skills or at least approximate memorisation of the keyboard layout or data entry will be very slow. There are a number of notebook PCs and personal note takers designed for Braille users. They have integral Braille keyboards, refreshable Braille displays and generally, a speech synthesiser interface.

Figure 2.27: Braille Keyboard (MaxiAids, 2013)

Some Braille keyboards have ‘hot keys’ that allow the user to toggle between Grade 1 Braille and Unified Braille Code. Combinations of the eight keys can be used to type all Latin based alphabet languages and all computer data, as
well as to obtain the function keys, cursor control keys and frequently used key combinations, involving ‘shift’, ‘control’, ‘alt’ and ‘delete’. A Braille keyboard also provides a potential communication approach for deaf-blind people, which may be faster than other types of finger spelling.

2.5.3.8 **Refreshable Braille Displays**

Braille output from a computer works in a very similar way to computer speech synthesiser output. The screen reader outputs what is on the screen to a Braille display.

**Figure 2.28: Refreshable Braille Display** (A-Z to Deafblindness, 2002)

The refreshable display usually has 20, 40, or 80 Braille cells each with 6 or 8 nylon or metal pins. As the characters on the computer screen are read these pins are moved up and down to represent the character read. On the screen 80 characters of text in one line may be presented to the Braille reader using an 80-cell Braille refreshable unit. This is a slow process and each page can take some time to be read. A positive benefit is that Braille output is usually very accurate. For example, spelling mistakes in the screen information are more likely to be identified in Braille than through a slight mispronunciation from a speech synthesiser. A Braille display sits in front of the keyboard or note taker. This allows the user to move quickly between inputting text from a QWERTY keyboard and reading the Braille display.
2.5.3.9 **Braille Embossers and Braille Translators**

Braille embossers are printers that print in Braille. It is not necessary to know Braille in order to print in Braille. Many different types of embossers are available. Some types can produce dots on both sides of the page (interpoint Braille). The idea is to create a regular document, i.e. in Microsoft Word, and print it. However, there is an additional step: the document has to be printed not from a Microsoft application, but from a Braille translation program. The program is sometimes included with the Braille embosser; sometimes it has to be purchased separately. Braille embossers are also designed to print graphs and graphics in raised dots, so that a blind person can feel them on paper.

**Figure 2.29 Braille Embosser** (Statewide Vision Resource Centre, 2012)

Once text has been input in Braille and saved, then it can be transferred to an ordinary PC and printed out as text using Braille translation software. This software includes the rules for producing Braille contractions and the formatting protocols required to print the Braille document. It is often necessary to pre-process the text document before the Braille transcription. Parts of the text that may require modification include tables, diagrams, and pictures; the latter may require replacement by text descriptions to make them accessible.
2.5.4 Limitations of Assistive Technology

Although assistive technology devices are meant to ‘assist’ and actually do assist people with impairments and solved their issues to a large degree; they have their own limitations. The major limitations are:

- **Training**
  Using assistive technology effectively and efficiently requires a good amount of training. Today’s assistive technology is far more complicated; while it is possible to use modern assistive technology without extensive training, this practice may not yield a very good outcome. When a screen-reading program is started and the user actually begins to hear spoken words, there is no assurance that he will benefit a great deal from the program. He must first learn various ways of getting the information from the screen in order to work quickly and efficiently. Similarly, users who know how to load the software that magnifies the text on a computer screen will not benefit from that act unless they know how to move around the screen in a quick and effective manner. (enableall.org). The lack of training and practice can not only lead to inefficient use of the device but also to user frustration to an extent that the user may stop using the device and may refuse to try assistive technologies in future.

- **Compatibility**
  Assistive technology to be used needs to be compatible in two ways. First, it must be compatible with the computer system it is to be used along. The system requirements and the device requirements should match each other to work. Second, the device must be compatible with the variety of formats of information, especially digital information formats. Websites for example, are many times not read well due to their design and non-conformance to accessibility standards.

- **Availability**
  The assistive devices may not be available in all countries especially economically and technologically backward countries. For successful use of assistive technologies, they should also be available commonly in public places like educational institutes, libraries, cyber cafes etc.
• **Affordability**

Financial constraint is a major factor acting as a hindrance in acquiring assistive technology devices. People requiring assistive technology may not be able to buy it. In such case, easy public availability of assistive technology plays a key role in their successful use.

In addition, the **Indian scenario** adds to the limitations. They are:

• India is a multilingual country. English is not India’s indigenous language; and hence not used commonly. This is even more true especially in case of people with low-literacy and rural background.

• Even in case of visually impaired people who understand English, they do not easily understand the accent used by the available software.

• Assistive technologies with Indian languages are not very common. Although there is research and development in progress in this area, very few assistive technologies developed with Indian languages are commonly and commercially available.

The section described what are assistive technologies, how they are categorised, the variety available, their benefits, and limitations. Even with their limitations, the benefits they offer, the degree of independence and satisfaction they provide to the users is one of the greatest rays of hope to the visually impaired who have to manage their entire life with their disability. Assistive technologies are definitely a boon to the disabled.

**2.6 ROLE OF LIBRARIES IN INFORMATION ACCESS FOR PEOPLE WITH VISUAL IMPAIRMENT**

The present study looks at the issues of information needs, availability and accessibility to students with visual impairment. The Universal Declaration of Human Rights has recognised that every individual has the right to “seek, receive and impart information” (United Nations, n.d.) and therefore has also recognised the right to access information. This has fuelled constructive efforts towards information accessibility in general and more in case of access
to information for people with disabilities; specifically for people with print disabilities. The United Nations Convention on the Rights of Persons with Disabilities (especially articles 9, 21 and 24) states that print disabled people have the right to equal access to books, knowledge and information at the same time, cost and quality as everyone else.

Providing information access is one of the key responsibilities of libraries. Libraries need to adopt several measures to ensure that they fulfil this responsibility towards people with visual impairment. The International Federation of Library Associations and Institutions (IFLA) promotes the right of people with a print disability to equitable access to all library and information services and supports international and territorial legislation that fights disability discrimination. To aid libraries serving people with disabilities, IFLA has issued a manifesto for libraries serving persons with a print disability and a description of key performance indicators for libraries serving print disabled people. To serve people with print disabilities, information needs to be provided in an accessible format. IFLA defines an accessible document as “A document which has been produced, recorded and/or stored in a format accessible for print disabled individuals. These formats may include:

- Braille, Moon, and other tactile printed formats
- Large and giant print, and other non-tactile printed formats
- Digital talking book, usually containing a mark up element (e.g. DAISY, with the following subdivisions: human narrated audio; human narrated audio and full text; synthetic speech and full text)
- Text-based content in other digital format (e.g. digital Braille, ePub, PDF, ASCII, Word)
- Non text-based electronic formats (audio, video, graphic, etc.)
- Analogue talking books (e.g. on audio cassette)
- Tactile or relief graphics
- Other accessible formats.” (IFLA, 2012)
The IFLA manifesto for libraries serving persons with a print disability serves as the guideline for libraries who wish to serve and improve services for print disabled. The manifesto recommendations are:

- All library and information providers, as part of their core services, put in place services, collections, equipment and facilities, which will assist individual users with a print disability to access and use resources that meet their particular needs for information.
- Library and information service providers are encouraged to consult individuals with a disability, and groups representing them, in the planning, development and ongoing delivery of services.
- The best services are provided by professionals who are aware of the needs of, and service options for, people with a print disability. Therefore IFLA encourages all library and information services to ensure that staff are adequately trained and available to work with users with a print disability, and supports career-long professional development and formal library and information studies programs, which will facilitate the strengthening of equitable library and information services to people with a print disability.
- It supports efforts to improve access to resources by people with a print disability through service agreements, referrals and sharing of resources between library and information services; and between these and other organisations specialising in services targeted for people with a print disability.
- Therefore IFLA encourages the establishment and development of an international network of libraries of accessible materials.
- IFLA supports efforts to ensure that copyright legislation enables equal access by people with a print disability to information from all libraries and information providers.

In addition to meeting legislative requirements, IFLA encourages the observation of universal design principles, guidelines and standards to ensure that library and information services, collections, technologies, equipment and
facilities meet the identified needs of users with a print disability. (IFLA, 2012)

However, only some components of physical and intellectual aspects of information access can be resolved by libraries while other aspects need to be resolved at international, national, societal and personal levels.

Information accessibility for people with disabilities (especially people with visual impairment) is thus a prerequisite for easy access to information and consequently better quality of life. Today, the world is focussed on providing ‘customised’ and ‘personalised’ services and experiences to a customer / user. Information access and services should be no exception to the customisation and personalisation option for people with disabilities.
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