Chapter 1: Introduction

In this digital age, the world of education has also undergone a major transformation. We can observe this change happening all around us in view of the fact that people of all age groups and occupation are going in for learning new courses or skills, particularly through distance education. These days, small kids learn to play complex video games and can use smartphones [1] take courses and video lectures online. Almost all industries use computers, database and simulation software to make their work computation & prediction driven and easier [2]. Search engines such as Google, Ask, Bing or online encyclopaedia such as Wikipedia are used increasingly to answer everyday questions by students, children and adults alike [3]. With the dawn of the digital age, the learning and education opportunities have been redefined which are very different from our conventional definition of education systems and learning. Not only this has helped to enrich and enhance our existing education system but also offered new opportunities and modes which can take the process of learning beyond institutions, thereby allowing people to learn on their own time and own terms. These new advances in learning have played a big role in knowledge enhancement of individuals and communities via different means. However, these advances give clear indication that we need to rethink about how to tap the technology potential for improving our education system drastically. In this chapter, to begin with, we will discuss the impact of computers and communication in revolutionizing the delivery of education and knowledge in day to day life. This will be followed by an introduction to IGNOU’s motto and our motivation & objectives for this study. This is given especially in view of the fact that IGNOU has been playing a very significant role in delivering learning using technology not only in India, but internationally. As we are restricting our study to physically handicapped students of IGNOU, we describe the relevant dataset followed by an outline of the thesis. In order to
introduce the subject matter of the thesis, we start discussion about *issues in new environment* in the next section.

**1.1 Rethinking education and knowledge in digital age**

One of the main changes that the technology has brought about is that it has given power of knowledge to the end user. Technology has enabled people around the world in taking education out of the school to their homes and internet cafés etc. These unconventional learning methods are definitely challenging our traditional model of education of learning in classroom. We can use these technologies to leverage the additional benefits of reaching to masses and support our education system.

The state of current education system in India also needs to be reconsidered at social level; nowadays there is an increasing pressure on the public and private schools alike to raise the level of education [4]. With continuously growing population of India not only the education institutions have to expand in number but also have to make sure that they deliver quality education to cater to larger masses and to operate sustainably. Especially private institutions have really proliferated in numbers. In view of this proliferation we have to ensure that the increase in quantity does not compromise the level and the quality of education. Also public or government institutions need to expand their reach to enable learning for masses for spreading literacy and education throughout India.

Population and the need for more education institutions is not the only problem plaguing the education system of India. Need for infrastructure as well as teachers constantly remain unfulfilled. The best teachers are leaving government/public institutions that need them the most, to join private institutions or even other occupations. The government so far has been unable to reverse the trend as these other opportunities offer mostly better money as well as career prospects. The new technology has the potential of meeting the above mentioned challenging. However, just developing the hardware and installing software will
not solve the problem. Appropriate pedagogy, management and paradigms of delivery have to be evolved in order to for the technology to meet the challenges properly. This justifies the need for research work of this type.

Education system needs to be reformed in order to keep pace with the growing needs of today’s society [5].

Despite the recent spurt in growth of private colleges and institutions in India, higher education is still not accessible to all [6]. In order to really make the new technology based paradigm of delivering learning and education effective, we have to understand the differences between the current structure of education system and true goal of educations. Figure 1 below shows how even today school/college learning has become a subset of lifetime learning and how other facets such as home learning and education for adult or self-directed learning contributed to the overall lifetime learning paradigm [7, 8].

![Figure 1: Technology can help us implement lifetime learning for masses in addition to traditional classroom learning.](image)

For proper understanding of the current educational scenario, we need to know levels at which technology is introduced in education. The Figure 2 below highlights the current stages
of the Indian education system with the respective usual age groups in those classes. Students may get introduced to computer application and computer sciences at various different levels, but it is very difficult to have students of same level in a class. But still, it has been previously demonstrated by the hole in the wall experiments [9], that use of computer even without any prior training can facilitate education and learning through self-organized learning and peer tutoring. Hence, using technology at any early stage in education can further promote peer tutoring thus making it very favourable for education society like India where the teacher to student ratio is rarely optimal.

![Typical stages of current Indian education system](image)

**Figure 2: Typical stages of current Indian education system**

The opportunities that can be provided with new technologies are endless. While the current system features uniformity in method of instruction irrespective of differences in students and teacher control, the new age technologies offer the benefits of customization, interaction irrespective of geographical or other disparities as well as user control. Technology based learning can also help generate more motivation by allowing people to pursue their own interests and dreams, design their own personal goals.

The knowledge revolution has already transformed most work practices and professional jobs. Many jobs which were work intensive before have become more knowledge intensive now [10]. The nature of work has changed from work intensive to
inferential and more abstract. Even if you consider a secretarial job for an example, where typically in past that would have involved typing documents or memos; now the same job function involves handling interactions with people inside and outside the corporation. This changing landscape of most work practices had led to widening gap between college educated and non-college-educated. To earn a decent living in the future now requires lifetime learning and expertise in dealing with and processing of all available information. Figure 3, highlights another example of how even a career of a farmer which was probably considered simple in the past has been significantly modernized data driven in the current times [11, 12]. Figure 3a) shows a scenario of the past where a Farmer is considering all the available factors such as seasonal factors, demand factors, resource availability etc. to the best of his knowledge and then planning his farming. Figure 3b) shows the current scenario where agriculture is considered similar to industry/engineering activity and all the data starting from logistics to climate (weather forecasting) and end user data is collected in databases and analysed using services and technology tools which guides farming decisions and activities. Applying IT to agriculture can solve problems of farmers by helping farmers. e- Sagu is one such platform meant for increasing crop production by providing timely advice. India is a country rich in biodiversity – climate, types of seasons, soil etc. Providing such facility to farmers in various Indian languages as per their requirement is one huge task. Automating such a system is another big ask. Similar problems occur in educations system due to change of subjects, migration by students & teachers and also differences may arise in curriculum due to differences in resources available, goals and needs.
Figure 3: Schematic highlighting how technology has impacted different fields in society

a) Scenario where a Farmer is considering all the available factors to the best of his knowledge to plan, b) scenario where agriculture is considered similar to industry/engineering activity

1.2 Distance Learning: IGNOU’s motto

Education sector today is one of the upcoming sectors due to demand, globalization, democratization and e-invasion. Education is a necessity of life as it enables human beings to not just earn a living but to lead a meaningful life in various other aspects as well. Education is a word synonymous with learning. Education or learning is not limited to school or college – where the type of learning imparted is formal mostly. Informal learning and non-formal learning (activities other than lectures) are other forms of learning.

The Indira Gandhi National Open University (IGNOU) is established to foster the idea of building an inclusive knowledge society through inclusive education. IGNOU’s thrust has been to increase the Gross Enrolment Ratio (GER) by offering high-quality teaching through the Open and Distance Learning (ODL) mode. The university aims to provide access to higher education to all segments of the society; and offer high quality programs to all at
affordable costs. Distance Learning targets students who can’t come to attend regular courses (formal). These students may fall in one or more of the categories listed below:

1. Disabled
2. Remote areas
3. Under privileged sections of the society
4. Women
5. Employed

In this thesis the student admission data of IGNOU is analysed to focus on the first student category. Other categories have been considered as well but within the disabled students’ category as attributes to varied extents.

The university, being a national university of India, operates through regional centres (RC). There is at least one RC in every state of India. The actual learning to the distance learner is delivered through Study Centres (SC) under the supervision of these RCs. At these study centres there are counsellors who interact with students, counsel them & solve their problems. IGNOU offers help and guidance to its distance learners in many forms. All the study material is uploaded in PDF (Portable Document Format) format [13] and video lectures [14]. There are blogs and wikis for further support, some part of which is under development. More information about IGNOU can be obtained from its official homepage [15].

For a general student, problems that exist in the education system due to diversity and globalization, lack of information, poor network, no refresher courses or training, commuting from work place/institution to home, poor management of institutions (hygiene, storage etc.). When it comes to teaching, all these issues are interlinked with learning. Lack of awareness, poor network, poor quality, digital divide, lack of interest and language are most common problems faced in an e-learning scenario. Consider deprived sections of society, they face
more problems than other students. Female students, pupil from remote area, lower strata of society need support from teacher, family and peers. Disabled students also need help.

**Disability**

Disability is an impairment that may be physical, cognitive, mental, sensory, emotional, developmental, or some combination of these [16].

In this research our concern is physically disabled pupil who are enrolled in various courses of IGNOU, we can divide them broadly in following categories:

1. Vision impairment: Person with visual impairment have partial or no vision. They can’t use mouse for input. They can’t see the screen. Correction requires magnification and colour contrast [17].
2. Hearing impairment: It means to have low or no hearing capability. While using computer they can’t hear audio, video, system alerts or alarms.
3. Locomotor impairment: They can’t use their limbs or limited use of limbs, tremors, limited range of movement, speed & strength.
4. Speech impairment: They have difficulty in speaking or have no speaking ability at all.

Such students require special attention and special use of technology for delivery of learning & education. There are some obvious incompatibilities between these new technologies and traditional classroom education system [18]. Teacher has to modify the existing teaching methods. Most of our current education system still largely focuses on traditional methods in which a set curriculum is taught in classes, there are very few teachers or institutions which embrace the change [18]. Even though colleges & schools provide computer labs and impart basic computer literacy to some students, they are still far from using technology for special education [18]. The revolution has still not penetrated where it can make the most impact on the system. To fully capitalize on the benefits of this
technology, the education system has to go beyond classroom teaching and include other techniques; a few of these are shown as an example in Figure 4. Such an education system can also be designed to be inclusive and adaptive to needs of students. This allows for a greater level of flexibility which is not easily attainable in the traditional education system.

![Diagram showing different components of a revolutionized education system]

Figure 4: An example of what a revolutionized education system might look like.

1.3 **IGNOU’s Contribution**

IGNOU helps its disabled students’ in the following ways:

- **Enrolment into Special Study Centres**: IGNOU’s SSCs (Special Study Centres) provide support for DDLs. Such students require specially tailored technology and manuals/documentation. Data supports that disability is more common in urban areas and male gender. Courses that teach educators about Special Education are run by National Centre for Disability Studies (NCDS), IGNOU [19]. Other supporting bodies at IGNOU are School of Continuing Education (SOCE), Staff Training and Research Institute of Distance Education (STRIDE), Inter University Consortium (IUC) and Electronic Media Production Centre (EMPC). IGNOU provides financial assistance, medals, awards & scholarships to motivate best of them.
Course Material

- Printed form: www.egyankosh.ac.in (free access to pdf files) using Acrobat Reader (free at www.adobe.com)
- Audio and video cassettes
- Gyan Darshan (Edusat) & Gyan Vani
  - [http://www.ignouonline.ac.in/broadcast/](http://www.ignouonline.ac.in/broadcast/): Requires window media player or adobe flash plugins, free from web.
  - [http://www.youtube.com/ignou](http://www.youtube.com/ignou): Download and save videos using YTD video downloader [20].

![Figure 5: Video streaming by Gyan Darshan](image)

Pedagogy:

- Course writers and translators need to choose words carefully i.e. stick to basic language instead of using adopted words. Provide simplest possible explanation of concepts (Occam's razor) [21]. To enable smooth reading of pdf files uploaded on egyankoash.ac.in IGNOU’s course writers adopt 1 column approach. Multicolumn approach makes text to speech tools task difficult.
1.4 **Motivation of the study**

IGNOU caters especially to the deprived sections of the society. Enrolment, performance (evaluation/assessment), migration, drop – out, finance (expenditure, fees etc.) are those various domains under which data gets accumulated. This data can be utilized to understand, highlight & solve various issues in the existing system. IGNOU has broadened this data domain further by conducting an online survey in the year 2010 called as *Student Satisfaction Survey*.

Data analysis is not limited to students’ aspects and variables. It is generated at staff (faculty and administrative employee) level as well – salary, perks, leave and performance. Academic data is generated in the form of library usages, university’s website & learning portal usage, download patterns class attendance, assignment & examination marks, time taken by teacher in assessment, pattern in checking etc.

The aim of this research is analysing enrolment data of disabled students of IGNOU for the year 2009 to find some hidden patterns that can indicate some research challenges or solve some problems of this particular section of the students. This is in accordance with the purpose of inclusive education which is an attempt to remove the direct or indirect preferences, grouping or selectivity existing in our present education system. In view of the fact that, because of large population in our developing country, skills that can be taught without literacy are difficult in our rigidly walled conventional system. How can we make IT so effective that an uneducated person can also use IT based systems (voice inputs, colour codes, hand or lip movements, image based clues / cues etc.)

1.5 **Aims and Objectives of the thesis**

The aim of this thesis is to study enrolment data of disabled students of IGNOU to identify their problems and to propose an e- Learning software / tool on the basis of observations. The first objective of this thesis work is to describe the provided datasets with
the help of visualizations. Second objective is to study various divides existing in the given datasets which might be limiting the interactions / education for disabled students. Third objective is to group disabled students using ID3 to form study groups to recommend peer(s) i.e. start of a PRS. Fourth objective is to suggest an e-Learning software / tool and modify the existing pedagogy methods for special education.

1.6 Data source

Data for this research was obtained from Student Registration Division (SRD) of IGNOU, in December 2009. There are two files on the CD/disc received – PH091 and PH092. Here PH stands for physically handicapped and 09 means year 2009. 1 and 2 following PH09 present the semester or cycle number during which IGNOU enrols students in its different courses. No associated key was provided by SRD, at the time of issuing the CD. The understanding of variables comes from official website and prospectus (containing enrolment forms & tables) for the same year as indicated in appendices at the end.

1.7 Outline of the thesis

In chapter 2, we cover a thorough study of existing vast literature on education, e-Learning and their subparts, distance education and use of multimedia in education. Educational Data Mining and Adaptive Educational Hypermedia are discussed as well in this chapter. In chapter 3, we discuss the Research Methodology for Educational Data Mining. Starting with the definition and nature of a research, we discuss about process and evaluation of research. This is followed by sections on scientific approach and nature of educational data mining research. In chapter 4, Data Mining using MS-Excel: Distributions & Graphs, a detailed data analysis of the enrolment data is presented with the help of graphs and charts to study various divides amongst the students. A justification about the data source and data cleaning strategy has also been provided. The results of analysis based on available data exhibit knowledge,
gender, generational and digital divide. Better methods are required to arrange feedback studies, surveys etc. Accordingly the forms used for student data need to be modified and digitized so that enrolment data is available and in a more data analyst friendly format. In chapter 5 a case study using ID3 is presented to show how rules can be generated and how grouping students for project work can help in interactions. This case study is cold start stage for a PRS i.e. Peer Recommender Systems. In chapter 6 Assistive Technology (AT) & Adaptive Software Tools, three main outcomes based on data analysis and review of literature are presented. First one is a mobile application program (app) DialAT as a one stop information portal and shop for disabled students. Modified pedagogy or teaching methods: lecture methods, demonstration method, collaboration method and group controlled method for special education of disabled students are presented as the second outcome. Three adaptive software tools – Link Removal, Stretch Text and Course Monitor–have been suggested using adaptive educational hypermedia to create friendlier interface and menus for disabled students. These tools constitute the third outcome. Here we also talk about types of disabilities, support from IGNOU, and aids for such learners & help for their families. These are followed by a discussion on user interface, smart classrooms, labs, and rights for such learners. In one of the sections, season of birth, a data analysis is presented from Educational Psychology domain. Finally, chapter 7 summarizes the conclusion and future work for this study.