



EKALAVYA MODEL OF HIGHER EDUCATION – AN INNOVATION OF IBM’S BIG DATA UNIVERSITY

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Abstract:

Big Data Science is a new multi-disciplinary subject in the society, comprising of business intelligence, data analytics, and the related fields have become increasingly important in both the academic and the business communities during the 21st century. Many organizations and business intelligence experts have foreseen the significant development in the big data field as next big wave in future research arena in many industry sectors and the society. To become an expert and skilled in this newly emerging field, we propose an effective and inexpensive learning model called ‘Ekalavya model’ of distance education heard in Mahabharata story of Indian Epics. In this paper, we have discussed the importance of Big data based data analytics. The advantages, benefits, constraints, and disadvantages of big data based analytics are discussed. In order to increase skilled data technicians called data engineers and scientists, we have discussed how Ekalavya model of knowledge and skill development can be used by utilizing various existing online skill development facilities with no financial investment and expenditure. The proposed Ekalavya model can be realized through opportunities and facilities provided by an innovative model of IBM’s Big data University. The paper contains the initiatives of IBM’s Big Data University to develop data scientists, data engineers, and business data professionals using online independent study by aspirants at their convenient time ubiquitously using Ekalavya model of Indian education system. We have also discussed how a student registered in IBM’s Big data University can choose different courses and decide their path of study in order to reach their aspiration to become Data Scientists, Data Engineers, and/or Business Data Professionals. Finally, we discussed how the Big Dream & Big Model of IBM supports to realize the new emerging higher education model of Competency Based Credit System.

Index Terms: Ekalavya Model of Indian Education, Online Ubiquitous Free Courses & IBM’s Big Data University

1. Introduction:

As the developments in the society progress, many professionals of different subject areas like computer scientists, physicists, economists, mathematicians, political scientists, bio-informatics, sociologists, and other scholars are clamouring for access to the massive quantities of information produced by various systems, people, things, and their interactions. Diverse groups argue about the potential benefits and costs of analyzing such massive data related to, for example, genetic sequences, social media interactions, health records, telephone directories, business processes, government records, and other digital traces left by people. Handling such data systematically created an emerging field called ‘Big Data Science’. Big Data Science is a new multi-disciplinary subject in the society, comprising of business intelligence, data analytics, and the related fields have become increasingly important in both the academic and the business communities during the 21st century. Many organizations and business intelligence experts have foreseen the significant development in the big data field as next big wave in future research arena in the industry and society. Many multi-branch and multi-national companies have developed and used various techniques for

processing and analysing data for finding relationships and intelligence which now comes under a single umbrella called data or business analytics which is expected to be a super-specialized area of business management and has huge potential for future growth. Based on a survey of over 4,000 information technology (IT) professionals from 93 countries and 25 industries, the IBM Tech Trends Report (2011) found that business analytics is one of the four major technology trends in the year 2010s [1]. In a report of the state of business analytics by Bloomberg Business week (2011), 97 percent of companies with revenues exceeding \$100 million were found to use some form of business analytics [1]. A report by the McKinsey Global Institute [2] predicted that by 2018, the United States alone will face a shortage of 140,000 to 190,000 people with deep analytical skills, as well as a shortfall of 1.5 million data-savvy managers with the know-how to analyze big data to make effective decisions [1].

2. Big Data Basics:

Data analytics techniques are used to process big data which is a collection of large datasets that cannot be processed for information using traditional data processing techniques. Big data is not merely data, rather it has become a complete subject of inter-related data produced by different devices and applications, which involves various tools, techniques, and frameworks. Big Data includes huge volume, high velocity, and an extensible variety of data produced by various business and research processes. Big data also refers to so-called unstructured data including sensor data, social media outpourings, video, and images that do not fit neatly into the rows and columns of most databases. Big data can be divided into of three types as structured data which include relational data, semi-structured data which include, XML data, and unstructured data comprising of Word, PDF, Text, Media Logs, etc. Some of the practical systems which generate big data include, black box data of airplanes, helicopters etc., social media data such as Face book, twitter, etc., Search data of various search engines, Business transaction data of multi-national and multi-branch companies, stock exchange data about stock prices and buyer- seller decisions, Transport systems data on vehicle model, capacity, distance and availability, Electrical grid data on production and distribution, mobile phone usage data of mobile service providers etc. The following section lists advantages, benefits, constraints, and disadvantages of big data in terms of organizational, service provider, users, and society point of views.

Advantages of Big Data:

- ✓ **Big Data Helps to Control Business Processes:** Big data generated by advanced computers and information communication networks are used to control various business processes.
- ✓ **Big Data Provides Competitive Advantage:** Big Data supports companies to outperform their competitors and new entrants by leveraging data-driven strategies to innovate, compete, and capture value by collecting and analysing data about products and services, buyers and suppliers, consumer preferences and intent.
- ✓ **Big Data Unlocks Business value by Making Information Transparent:** A significant amount of information that is not yet captured in digital form, e.g., data that are on paper, or not made easily accessible and searchable through networks, can be captured, analysed and used for improving corporate decisions.
- ✓ **Organisations get the Opportunity to Create, Store, and Analyse More Transactional Data in the Digital Form:** Organizations can collect more accurate and detailed transactional information on everything from product

inventories to sales and therefore expose variability, boost performance, and help to make better management decisions.

- ✓ **Helps to Real-Time Customization of Products and Services:** Big Data supports to narrow segmentation of customers and hence much more precisely tailored products or services.
- ✓ **Big Data Provides Sophisticated Analytics to Analyse the Data:** Big Data analytics can substantially improve decision-making, minimise risks, and unearth valuable insights that would otherwise remain hidden.
- ✓ **Development of New Products & Services:** Big Data can be used to develop the next generation of products and services. For instance, manufacturers are using data obtained from sensors embedded in products to create innovative after-sales service offerings such as proactive maintenance to avoid failures in new products.
- ✓ **Company Business Analysis:** Big Data are useful in analysing the brand, products, customer service satisfaction and customer sentiment, of many companies.
- ✓ **Creation of Detailed Stakeholders Information:** Big data allows companies to create more in-depth personal profiles of their customers, regardless of whether they are B2B or B2C. It allows to combine data from social networks, blogs, online surveys, click behaviour, sales data and both public and open data in order to create detailed personas profiles.
- ✓ **Customized and Personalized Websites for E-Business:** Real-time big data enables E-business companies to personalise the look and feel of both their content and website in real time to suit customers preferences and needs. For example, in the case of an online advertisement, a company has the ability to personalise its advertisements for different viewers depending on their personal profiles.
- ✓ **Possibility of Emergence of New Business Models:** Since the information is coming from structured and unstructured data, companies have opportunity to gain deep insights into all aspects of business using big data and big data analytics which will allow for the growth of new business models as companies find ways to combine the vast wealth of available information.

Benefits of Big Data:

Big data is really critical to our life and its emerging as one of the most important technologies in modern world. Some of the benefits of big data are:

- ✓ Using the information kept in the social network like Facebook, the marketing agencies are learning about the response for their campaigns, promotions, and other advertising mediums.
- ✓ **Improves Business Intelligence:** The Big data collection process plays a major role in improving business intelligence.
- ✓ Using the information in the social media like preferences and product perception of their consumers, product companies and retail organizations are planning their production.
- ✓ Using the data regarding the previous medical history of patients, hospitals are providing better and quick service.
- ✓ **Cost-Effective Revenue & Enhanced Profit:** The data sources available to businesses are free of cost. This increases the potential operating margins and hence profit through use of big data.

- ✓ **Creates Huge Job Market:** Every medium and large companies need big data analyst for systematic generating, processing, and analysing Big data. According to Harvard Business Review, the 21st century's sexiest job is the data scientist.
- ✓ **Business Error Detection & Control:** Big Data analytics allows businesses to detect errors and fraud quickly. This significantly mitigates against losses.
- ✓ **Improved Profit & Customer Service:** Real-time analysis allows businesses to develop more effective strategies and offers them a chance to improve profits and customer service.
- ✓ **Improved Quality of Decision:** Identifying significant information that helps the managers to improve decision quality.
- ✓ **Effective Handling of Business Risks:** Mitigating risk by optimizing the complex decisions of unplanned events more rapidly.

Constraints of Big Data:

- ✓ **Big Data Acquiring:** Difficulty in acquiring big data in regular intervals, storing and processing them continuously is a challenge.
- ✓ **Managing Big Data:** Acquiring the right skills and resources in order to manage the increased volume of data, customer, and market insights that the companies will be receiving on a daily basis.
- ✓ **Technology Constraints:** Companies may need to turn to cloud based technologies in order to handle the space required to store big data.
- ✓ **Data Analysing & Understanding Skill Sets:** Companies also need to ensure that their employees have the skill sets needed to analyse and access the volume of data in an efficient way.

Disadvantages of Big Data:

- ✓ **Business Complexity:** Searching for business intelligence through Big Data analytics gives additional responsibilities and processes which makes the business tasks more complex.
- ✓ **Ethical Issues:** There are sensitive ethical issues connected with what data is collected and their behaviour, what use is made of it and by whom.
- ✓ **Issues of Data Quality & Reliability:** Difficult to assess accuracy of the data and uncertainty in its generation.
- ✓ **Privacy & Confidentiality:** Maintaining privacy, confidentiality, and security about Big Data by organizations.
- ✓ **Business Complexity:** Searching for business intelligence through Big Data analytics gives additional responsibilities and processes which makes the business tasks more complex.

Big Data Technologies:

Big data technologies are important in providing more accurate analysis, which may lead to more concrete decision-making resulting in greater operational efficiencies, cost reductions, and reduced risks for the business. To harness the power of big data, companies require infrastructures capable to manage and process huge volumes of structured, semi-structured, and unstructured data in real-time and to protect data privacy and security. There are various technologies in the market from different vendors including Amazon, IBM, Microsoft, Oracle, etc., to handle big data. There are two classes of important technologies developing independently to handle big data [3]. They are Operational Big Data and Analytical Big data. Operational Big Data include systems like Mongo D.B. That provides operational capabilities for real-time, interactive workloads where data is primarily captured and stored. NoSQL Big Data systems are designed to take advantage of new cloud computing architectures that

have emerged over the past decade to allow massive computations to be run inexpensively and efficiently. This makes operational big data workloads much easier to manage, cheaper, and faster to implement. Some NoSQL systems can provide insights into patterns and trends based on real-time data with minimal coding and without the need for data scientists and additional infrastructure. Analytical Big Data includes systems like Massively Parallel Processing (MPP) database systems and Map Reduce that provide analytical capabilities for retrospective and complex analysis that may touch most or all of the data. A new method of analyzing data by means of Map Reduce is complementary to the capabilities provided by SQL, and a system based on Map Reduce that can be scaled up from single servers to thousands of high and low-end machines. These two classes of technology are complementary and frequently deployed together.

3. Ekalavya Model of Distance Education in Indian Epics:

The story of Ekalavya (a character from the Indian epic- Mahabharata) has exemplary discipleship with an innovative model of distance education [4]. Ekalavya was the son of a poor hunter. He wanted to learn archery to save the deer in the forest that were being hunted by the leopards. So he went to Dronacharya (a master of advanced military arts) and requested him to teach him archery. Dronacharya was the teacher of the Royal family. But being a teacher to the members of Royal family Dronacharya was not allowed to teach the archery to anybody else. Dronacharya, bound by the state law, could not accept him as his student. But Eklavya deeply desired to study under Dronacharya. Eklavya in his heart had already accepted Dronacharya as his Guru. He went home and made a statue of his Guru. Over the following years, with sincerity and practice, he learned archery and became better than the state princes in the archery skill art. He became so good at it that, he would hear the sound of the animal, shoot an arrow at it and claim the animal [4]. This is the part of Ekalavya story where a boy who is determined to study archery enabling to become a master using distance-learning model. This idea of distance learning to enhance skills is becoming more relevant using technology. The idea of distance education, named Ekalavya model of Education, without a physical teacher, is predicted thousands of years before and now such ideas are realized through online ubiquitous education model using information communication technology.

4. Higher Education – Online Opportunity:

The developments in education system using technology and pedagogy made the training system more effective and presently students are enjoying the experimental and choice based education systems at all primary, secondary and higher education level. Using the model of self-learning with the aid of audio and video information is becoming more popular and easily adaptable among the children [5]. Innovations in higher educational system covered long way and its contribution improved the quality of education and quality of graduates [6-7]. Several studies on innovations and quality in higher education including Strategic Planning in Higher Education Institutions [8], Innovations and Best Practices can Transform Higher Education Institutions [9], quality in higher education [10], Internal Quality Assurance Cell and its Contribution [11], Enhancement of Graduate attributes in Higher Education Institutions through Stage Models [12], Quality Enhancement in Higher Education Institutions [13], Effective Leadership and Governance [14], Strategy Development and Deployment in Higher Education Institutions [15], Faculty Empowerment Strategies in Higher Education Institutions [16], Unique & Successful Model in Integrated Development [17], Applying SWOC Analysis to an Institution of Higher Education [18], Techniques for Electric

Energy Auditing in Education System [19], Societal Expectation And Institutional Accountability in Higher Education [20], Methods and Approaches for Employability Skill Generation in Higher Educational Institutions [21], Quality Enhancement in Higher Education Institutions through Best Practices in Library [22], Analysis of Academic Administrative System Implemented in Higher educational institution [23], Learning through Team Centric Exercise & Key Point Pedagogy - An effective Learning Model for Slow Learners in Higher Education Training [24], Opportunities and Challenges for Private Universities [25], Innovations in Private Universities [26], Creating Innovators through setting up organizational Vision, Mission and Core Values : a Strategic Model in Higher Education [27], Comparative Study on MBA Programmes in Private & Public Universities [28], Impact of On-line Education on Higher Education System [29], Innovations in Higher Education - A new model implemented in MCA degree programme [30], Environmental Consciousness in Higher Educational Institutions [31], Analysis of Choice Based Credit System in Higher Education [32], Innovations in Student Centric Learning - A Study of Top Business Schools [33], Innovations in Experimental Learning - A Study of World Top Business Schools [34], How to Increase Research Productivity in Higher Educational Institutions [35], Academic Support through Information System [36], and Quality Teaching and Learning as Practice Within Different Disciplinary Discourses [37], Innovative Education Model to realize Ideal Education System [38], ABCD analysis of Stage Model in Higher Education [39]) Analysis of NAAC Accreditation System using ABCD framework [40], Application of ABCD Analysis Framework on Private University System [41], The Study of New National Institutional Ranking System using ABCD Framework [42], Educational institutions quest for service quality: customers" perspective [43], Comparative study of quality practices in higher education institutions [44], Quality in higher education-a survey [45], Blended learning: Uncovering its transformative potential in higher education [46], Innovations in Experimental Learning - A Study of World Top Business Schools [47], Academic Support through Information System [48], Changing Approaches in Campus Placements - A new futuristic Model [49], Information Technology Innovations in Library Management [50], Teaching - Learning Process in Higher Education Institutions [51], Maintaining Teacher Quality in Higher Education Institutions [52], Student performance and Learning Outcomes in Higher Education Institutions [53], Catering Student Enrolment and Retaining Diversity in Higher Education Institutions [54], Student Evaluation and Reforms in Higher Education Institutions [55], An innovative education model in Corporate Auditing [56], Student Centric Learning Through Planned Hard work - An Innovative Model [57], Green Placement - An Innovative Concept & Strategy in Campus Placement Model [58], Review on Various Ideal System Models Used to Improve the Characteristics of Practical Systems [59], Green Education Concepts & Strategies in Higher Education Model [60], and Smart Library Model for Future Generations [61] are studied and published.

Online education for learning anywhere anytime has made rapid progress in the recent times, making it one of the most analysed and discussed subject in higher education system. There are a number of models developed on how to deliver education effectively using much-tested pedagogy. All of these models may not end up thriving in the long-term, but the following models have the potential for attracting the learners. These models differ in terms of course design, pedagogy and the channel by which information is created and transmitted. Some of the online education models are (1) Traditional full-time classroom based face-to-face programs, (2) Traditional part-time classroom-based programs, (3) Non-Profit Online Programs, (4) Profit-based Online

Programs, (5) Online Competency-based education model, (6) Open Education Practices, (7) Massively Open Online Courses, or MOOCs, (8) Flipped Classrooms, (9) Self-learning, (10) Complete online competency-based Higher education through Mobile Devices. The main advantages of online mobile education for the global students are listed as follows [62]: Ubiquity- anytime, anywhere, and any amount of time availing education training, Personalization - courses, services, and applications can be personalised and customized, Reduced Costs - availing and using various courses and services online is cost effective, Flexibility -students may be engaged in activities such as working or travelling, while doing their study online, Increased Comfort – students can avail required courses from any global university, the service is available 24 hours a day without requiring the physical interaction with the instructors, Time Saving -by the automation of education services including access to study materials, video lectures, online assignment submission, online interaction/discussion with both instructors and peer students, online exam and evaluation etc., and Convenience - ability and accessibility provided by online systems from any course, topic, anywhere any university, and any time [5]. There are many online education systems/portals providing online education in higher education system online among them the prominent are edX, Alison, Ucity, Coursera, Big data university, and NPTEL consortiums are offering innovative models of online training programmes.

5. IBM's Big Data University Initiative:

The Big Data University is an IBM community initiative and is not like other on-line training sites. In Big Data University the course content is free, access to tool sets used within the courses is free, and the courses are designed to be accessed at learners pace based on their priorities. With the mission of giving the benefits of analysis, data science and potential learning from Big Data to the interested people of the society which solves the problem of lack of people with skills in this area, IBM had a desire of providing opportunities to learn the fundamental concepts required to develop, process, and analyze big data and break down the traditional barriers to participation in this sector. As per Big data University, the two driving reasons why the interested people have to undergo online courses on subjects related to big data analytics are:

- ✓ Familiarity and hands-on experience with groundbreaking technology for free, and
- ✓ Having the confidence to build and contribute to this community with the foundational skills to make a difference.

Big Data University is not an accredited institution for awarding any degree in data analytics, but they award IBM recognized IBM Open Digital Badges that can be displayed on individual profile/resume. These badges can be also submitted during competency evaluation of students in any university for getting degrees.

IBM Big Data University has developed three sites for the worldwide audience as shown below:

- ✓ BigDataUniversity.com: this site aimed at the world at large and provides courses in English, but does have some courses in Japanese, Spanish and Russian.
- ✓ BigDataUniversity.com.br: launched at the end of July 2015 for students in Brazil. It offers courses in Portuguese.
- ✓ BigDataUniversity.com.cn: launched at the end of August 2015 for students in China. It offers courses in Mandarin. The site and all of the course material are hosted in China.

IBM is hoping to help create the next generation of "big data" specialists through a series of partnerships with universities around the world, as well as influence the

curriculum of these universities so that students can learn by registering with Big Data University and accessed for the competency by the Universities for awarding degrees [63].

The youngsters who are interested in becoming data scientists, as there are a large number of universities that IBM and other industry vendors are now partnering with to develop undergraduate and graduate degree programs designed to prepare students for Big Data and Analytics careers. Traditional academic establishments have begun to move to fill the gap. However, most courses teaching the hot topic skill sets such as machine learning and predictive modelling are graduate level, with a high barrier to entry. This has created an opportunity for online distance learning providers, which can move far more systematically to adapt to demand. It's Big Data University initiative has now signed up over 400,000 students [63]. Although it doesn't charge for any of its courses, it takes a business-centric approach to delivery which sets it apart from many other online open course providers. At Big Data University, students can sign up independently at home and work at their own speed and on their own initiative, just as they can with Coursera and edX or other similar services. However, IBM also works with partners to tailor course packages to fill the needs of individual organizations. And it allows (actually, encourages) third party vendors to sell on their free course material while adding their own value such as custom delivery and support packages. Another innovation in IBM's model of delivery is a focus on applying the skills which are taught. Students can all download the open source Big Data Workbench toolset and are given practical real—world problems to solve. This gives the student a sense of real-world achievement, seen by the university as vital in motivating self-learners and distance-learners.

Big Data University (BDU) has partnered worldwide with organizations including Tata Consulting Services, Trans Neuron Technologies, and Cognizant for providing online training. Recently, it has launched a customized website for China and announced a partnership with Kaitan-Weibo, an educational division of the social media giant Weibo. Big Data has also started a wave of changes in the ways that more traditional subjects are taught. Distance and online learning provide opportunities for more in-depth investigation into how, and why, people learn efficiently. The changing needs of employers mean they are likely to want to integrate analytically trained staff across an increasingly wide segment of their business. The need for these “citizen data scientists” – nondata-scientists with data science skills has been forecasted to grow five times more quickly than the need for people specifically trained as data scientists. The Big Data University is working to meet such need [63-67].

6. Big Data University Courses & Study Paths:

Table 1: About Courses

S.No	Course Name	Course Level	No. of Modules	Time to Complete	Requirement
1	Data Science 101	Beginner	05	03	None
2	Big data 101	Beginner	05	03	None
3	Data Science Hands-on with Open Source Tools	Beginner	05	05	None
4	Hadoop 101	Beginner	04	05	None
5	Spark Fundamentals	Beginner	05	05	Hadoop 101
6	Machine Learning 101	Beginner	05	04	Python Programming
7	Deep Learning 101	Intermediate	04	05	None
8	R 101	Beginner	05	05	None

9	Data Science Methodology	Beginner	05	05	None
10	Text Analytics- – Getting Results with System	Beginner	05	09	None
11	Advanced Text Analytics – Getting Results with SystemT	Advanced	02	03	None
12	Watson Analytics 101	Beginner	07	04	None
13	Scala 101	Beginner	05	06-08	Java/Python
14	Data Journalism – First Steps, Skills, and Tools	Beginner	05	06	None
15	Predictive Modelling Fundamentals 1	Intermediate	05	05	None
16	Analyzing Big Data in R using Apache Spark	Beginner	06	04	None
17	Spark Overview for Scala Analytics	Beginner	05	07	Java/Python & Scala 101
18	Map Reduce and YARN	Intermediate	05	05	Big data 101 Apache Hadoop Java/Python & Scala 101
19	Apache Pig 101	Beginner	05	05	Big data 101 Apache Hadoop, Linux OS
20	Simplifying Data Pipelines with Apache Kafka	Intermediate	05	03	Big data 101 Apache Hadoop Java/Python & Scala 101, R
21	Data Science with Scala	Intermediate	05	6-8	Java/Python Machine Learning 101 Scala101, Spark Overview
22	OpenRefine 101	Beginner	05	07	Spreadsheet software & Different data write
23	Machine Learning – Dimensionality Reduction	Beginner	03	02	None
24	Data Privacy Fundamentals	Beginner	05	05	None
25	Digital Analytics &Regression	Beginner	05	05	Basics of R
26	Spark Fundamentals II	Intermediate	05	04	Big data 101 Apache Hadoop Java/Python & Scala 101, R
27	NoSQL and DBaaS 101	Beginner	05	05	HTTP, and JSON, Linux
28	R 101 (by DataCamp)	Beginner	06	04	Basic statistics Basic programming
29	Accessing Hadoop Data Using Hive	Intermediate	05	05	Big data 101 Apache Hadoop SQL, Linux OS,
30	SQL Access for Hadoop	Intermediate	02	03	Hadoop 101, SQL
31	Using HBase for Real-time Access to your Big Data	Intermediate	06	05	Hadoop 101, Big Data
32	Analyzing Big Data with a spreadsheet UI	Beginner	03	03	Hadoop 101, Big Data, Apache Hadoop, Linux OS,

33	Developing Distributed Applications Using ZooKeeper	Intermediate	03	04	Hadoop 101, Linux OS, Eclipse IDE.
34	Controlling Hadoop Jobs Using Oozie	Intermediate	03	04	Hadoop 101, Linux OS,
35	Moving Data into Hadoop	Intermediate	05	04	Hadoop 101, Big data, Java/Python & Scala 101,
36	Solr 101	Beginner	04	03	SQL, Linux OS,
37	Bitcoin 101	Beginner	04	04	None
38	Getting Started with the Data: Apache Spark Makers Build	Beginner	02	02	None
39	Data Science Methodology - Version 1 (Archived)	Beginner	08	04	None

Table 2: About Study Paths

S.No	Study Path	Courses in the Group	Background Requirement
1	Data Science Fundamentals (4 Courses)	Data Science 101, - 3 Hours Data Science Methodology, - 5 Hours Data Science Hands-on with Open Source Tools, - 5 Hours R 101, - 5 Hours	Beginners, Aspiring Data Scientists
2	Big Data Fundamentals (3 Courses)	Big Data 101, - 3 Hours Hadoop 101, - 5 Hours Spark Fundamentals I, - 5 Hours	Beginners Big Data Enthusiasts, Data Engineers, Data Scientists
3	Data Science for Business (3 Courses)	Data Privacy Fundamentals, - 5 Hours Digital Analytics & Regression - 5 Hours Predictive Modeling Fundamentals I, - 5 Hours	Beginners Business Professionals
4	Scala Programming for Data Science (3 Courses)	Scala 101, - 6-8 Hours Spark Overview for Scala Analytics, - 7 Hours Data Science with Scala, - 6-8 Hours	Beginners Data Scientists, Data Engineers
5	Hadoop Fundamentals (4 Courses)	Hadoop 101, - 5 Hours MapReduce and YARN, - 5 Hours Moving Data into Hadoop, - 4 Hours Accessing Hadoop Data Using Hive, - 5 Hours	Beginners Data Scientists, Data Engineers
6	Spark Fundamentals (3 Courses)	Spark Fundamentals I, 5 Hours Spark Fundamentals II, 4 Hours Analyzing Big Data in R using Apache Spark, - 4 Hours	Beginners Data Scientists, Data Engineers

7. Analysis of Study Paths:

The courses are devised and run by volunteer members of the Hadoop, big data and database global communities who are employed by IBM and some of its BDU business partners. The classes fall into three basic categories: big data-related topics, database related topics and miscellaneous topics. The curriculum at BDU is flexible, with no prerequisites for courses. But there is a suggested path for students as mentioned in the previous section. For example, under the big data category, the Big Data University provides the following suggested course sequence: Big data analytics demo, Hadoop Fundamentals I, Hadoop and the Amazon Cloud, Hadoop and the IBM Smart cloud Enterprise, and Hadoop Fundamentals II. Students who have more interest in the analytics aspect are advised to start with Big data analytics demo before proceeding to Spreadsheet-like analytics, Text analytics essentials, and Query languages for Hadoop. In Big Data University, each course includes a test students can take

following their studies. Students who pass can print out a certificate of completion. How long a student takes to complete a course is pretty much up to them at their own pace which further depends on a student's familiarity and experience with the topic matter. Registered learners who have a background in data mining or analytics for structured data have the opportunity to expand their knowledge easily into the big data world and such people should be able to go through the curriculum in a few weeks. Others with no background in data mining and analytics may take few more months to understand all the information in a curriculum category [64].

8. The Big Dream & Big Model to Realize Competency Based Credit System:

Competency-Based Credit System (CBCS) is an emerging higher education model expected to significantly improve the education system. It provides an opportunity to personalize the learning process in higher education by means of providing a proper direction while choosing the subjects, and in assessment. Competency-based programs allow students to demonstrate academic competence through a combination of assessment and documentation of experience to gain academic credit. In this model, the students can learn a given topic or subject in any mode but have to take systematic examination/evaluation of their knowledge or skills in an accredited University to get qualify for the higher level of study. CBCS allows students to progress at their own pace, incorporates the process of prior learning assessment, and offers a logical framework for improving knowledge, skills and experience as per the demands of the industry to the extent decided by the institution. A student need not necessarily have to take predetermined required and elective courses to be taught by approved faculty members. Rather, it would mean that a student has demonstrated a defined set of proficiencies and mastery of knowledge and content in a systematically designed evaluation system to get the qualifying degree certificate [5] through they study the course through online ubiquitous mode from any online university. In this regard, IBM's Big data University, even though is not a formal degree-giving university can support the aspiring students to learn the required skills and knowledge through Ekalavya model, at their own pace by following earn-while-learn model of higher education but eligible to take systematic examination/evaluation of their knowledge or skills in an accredited local University to get academic degree for further studies.

9. Challenges & Opportunities for IBM's Ekalavya Model:

IBM has developed various courses in systematic model to provide knowledge, skills and experience to work with Hadoop and Smart cloud Enterprise, Data Science for Business, Big data analytics, and Query languages for Hadoop for interested learners by providing both video lectures and demonstrations using open source software. The IBM Big Data University guides the registered students to choose different study paths based on their background, future career plan etc. for free. The following challenges and opportunities are identified for Ekalavya Model from learners point of view:

Opportunities:

- ✓ Opportunity to become expert in Big data Handling by studying online with Big Data University.
- ✓ Ubiquitous opportunity for everybody to acquire expertise in Big data handling irrespective of their gender, age, country, race and prior education etc.
- ✓ To study new high tech skill systematically by world top organization using an easy and simple understandable model.
- ✓ Since the courses are free, any interested person can register online and acquire skills in their free time and in their own pace.

- ✓ Students registered for any other regular courses in any University can study Big Data University courses simultaneously during their free times.
- ✓ Graduates and Postgraduates with additional skills in Data analytics get better employment opportunities with lucrative salary and promotions.
- ✓ Online examination after completion of each unit.

Challenges:

- ✓ Procrastination
- ✓ Background knowledge
- ✓ Independent study
- ✓ No peer group for discussion
- ✓ Internet/online learning facility is required.
- ✓ Follow-up and continuation while persuading the courses.

10. Conclusion:

Many organizations and business intelligence experts have foreseen the significant development in the big data field as next big wave in future research arena in many industry sectors and the society. To become an expert and skilled in this newly emerging field, we propose an effective and inexpensive learning model called 'Ekalavya model' of distance education heard in Mahabharata story of Indian Epics. In this paper, we have discussed the importance of Big data based data analytics. The advantages, benefits, constraints, and disadvantages of big data based analytics are discussed. In order to increase skilled data technicians called data engineers and scientists, we have discussed how Ekalavya model of knowledge and skill development can be used by utilizing various existing online skill development facilities with no financial investment and expenditure. The proposed Ekalavya model can be realized through opportunities and facilities provided by an innovative model of IBM's Big data University. The paper contains the initiatives of IBM's Big Data University to develop data scientists, data engineers, and business data professionals using online independent study by aspirants at their convenient time ubiquitously using Ekalavya model of Indian education system. We have also discussed how a student registered in IBM's Big data University can choose different courses and decide their path of study in order to reach their aspiration to become Data Scientists, Data Engineers, and/or Business Data Professionals. Finally, we discussed how the Big Dream & Big Model of IBM supports to realize the new emerging higher education model of Competency Based Credit System.

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