

# THE INTERNATIONAL JOURNAL OF SCIENCE & TECHNOLEDGE

## Big Data in Education; Future Technology Integration

**Samson Oluwaseun Fadiya**

Management Information System, Girne American University, Cyprus

**Dr. Serdar Saydam**

Management Information System, Girne American University, Cyprus

**Emeka Joshua Chukwuemeka**

Information and Communication Technologies in Education  
Eastern Mediterranean University, Cyprus

### **Abstract:**

*In recent years, the education sector has vied to cope with volume, variety, and velocity of data that is created within their own enterprise and across the education system. A new emergence of Big Data technologies is proving highly improved in operation than the existing data warehousing, although Big Data is heavily unstructured, voluminous and stream rapidly. The challenges of education in the current time anticipate for a complete explore that can make available the function and efficiency of big data in education system technology. However, the good thing is that Big Data can individualize instruction, particularly within the e-learning industry. The use of big data analytics can construct a novel system for improving teaching and discovering the prospect for valuable research, evaluation, and accountability through technology integration like data analytics, web dashboards and data mining in education.*

*In this paper, we will depict a design and implementation of the basic structure that will contribute unitedly the tools. A preparation of super-high-speed email technology for real-time, which will render learners and organizations to have speedy access to streaming data capture and monitoring and the data to offer access to investigators in the area of advanced education institutional research.*

**Keywords:** Big data, data analytics, data collection, data integration, real-time

### **1. Introduction**

The depth of big data in business or education is fast advancing, though higher education institutions are challenged by heightened contention, ranging from financial challenge, and challenge with a unique opportunity in technologies, enlargement of various demands from the student and staffs bodies and increased demands for accountability [6]. Now, considering the huge amounts of data, real-time data, next generation data, social media, analytics, data management capabilities, and many more, organizations are beginning to realize and research how to process and analyze a large layout of information in different ways. In performing that, a growing group of pioneers in different fields of big data is achieving a productive insight business results. Companies and experts acknowledge all over the world will need to gain more expertise on how to manipulate or exploit big data. Notwithstanding the media persist, although it can be difficult to find extensive information on what establishment are truly executing.

These stimulating situations call for research that can provide a broad scope of understanding about the operation and skillfulness of higher education institutions in their four primary missions: research and data analysis, education, training, administration and other service. In proper readiness for this to happen, it is significant toward researchers having access to data that goes outside depicting distinctive educational prominent attribute. A boastful diversity of data references reporting not only educational, but also unlike social statistics on the Internet. Still, applying data from distinctively separate sources could be Challenging, even when the data are publicly accessible that describe different aspects of institutional research. The deficiency of accessibility and availability data is a big-name.

Also, the development of computerized learning modules enables assessment of students in systematic, real-time methods. Data analytics software can provide immediate response to students and teachers concerning academic functions. That approach can analyze underlying forms in order to predict student outcomes such as dropping out, needing extra help, or being capable of more demanding assignments [4]. For example, an online university assignment submission and research feedback online make students connects to the real world problems and helps students learn key concepts in their chosen field of study. Online platform allows people to share thought easily ad create a room for learning excellence.

Usage of this software allows teachers to mine learning patterns to see how students master their different field of choice. And this can be done through embedded assessment tools. However, Data analytics are a breakthrough; learner analytics are beginning to be employed in education. The demands are received and the possibility of such attempts for improving student results and the productivity of university systems. The goal is to help educate policymakers and administrators understand how data analytics

operates and how they can be utilized in online learning systems to back up education-related decision making in the University environments.

## 2. Related Works

With the advent of computerized instruction, scholars argue that the specific types of feedback are crucial for improving learning. For example, David Nicol and Debra MacFarlane-Dick outline seven principles of effective feedback. They include clarifying what good performance is, facilitating self-assessment of learning, delivering high quality information to students, promoting peer dialogue around learning, encouraging positive motivations, showing how to close gaps between current and desired performance, and providing information to teachers on effective feedback [1].

It is possible to take these principles and evaluate learning in more detailed ways. Vincent Aleven and his colleagues at Carnegie Mellon University run controlled experiments through Intelligent Tutoring Systems. These experiments provide tools through which professors can develop online tutorials in areas such as chemistry and physics, and compile pre-test and post-test assessments plus detailed records of interactions between students and electronic tutors. These types of computer tutorials can evaluate problem-solving approaches and provide feedback along the instructional path. The system sends error messages if the student follows an incorrect approach and provides answer hints if requested by the student. Instructors can get a detailed analysis not just of whether the student reached the final answer correctly, but how they solved the problem [3].

Research by James Theroux of the University of Massachusetts at Amherst found that embedded assessment “engages and satisfies students at a higher level than do average courses and presents a more realistic and integrated view of business decision making.” [2]. A clear majority of pupils preferred the online over a traditional approach and felt the course materials were very applicable to real life. The case helped faculty assess the degree to which students’ grasped management.

Big Data can have a profound impact on American education and our competitiveness in the global economy. For example, through in-depth tracking and analysis of on-line student learning activities – with fine grained analysis down to the level of mouse clicks, researchers can ascertain how students learn and the approaches that can be used to improve learning. This analysis can be done across thousands of students rather than through small, isolated studies [8]. Courses and teaching approaches, online and traditional, can be modified to reflect the information gleaned from the large scale analysis.

The potential applications of Big Data described below serve to illustrate the “Art of the Possible” in the potential value that can be derived. These applications are consistent with the recently published Digital Government Strategy [9]. They require a customer focus and the ability to reuse and leverage data in innovative ways.

## 3. Analytics in Education

Data analytics has captured the attention of not just a business leaders and technology companies but also educational sectors. The comprehensive hope of analytics is that novel knowledge can be benefitted from in-depth analysis of the data mark imparted case-by-case in their mutual action with others, information, Technology, and organizations. The speedy exploitation of “big data” logical arrangements and tools go with modern measurement, management and processes in larger companies. The intersection of data and insight data analytics can be express as “business intelligence”. In other word, in the education sector, this data analytics or data mining may fall into two categories: Learning or Open Learning analytics and Academic analytics.

Learning analytics (LA) are pertaining to improving students (Learner) success by covering of data about learners and their contexts that the collection, measurement, and data analysis for use of understanding and maximum efficiency for learning. Academic analytics is the advancement of system organizational resource allocation, processes and workflows. Academic analytics, cognate to business analytics, are concerned with improving organizational data collection and effectiveness.

The Learning analytics grips the hope of a more vigorous analytics outcome, effectiveness and good output in education. And help decision makers, learner and educators with sound insight to classroom activities and course level.

### 3.1. Benefit of Big Data Analytics in Education

#### 3.1.1. Learning Analytics

The benefits of LA include accommodate learning process and capacity, making sure that each learner obtains resources, support and teaching that shine their stream know-how state. The advance quality learning pattern processes through the use of data supplied during real time education actions.

Also, Learning analytics construct an improved function of teacher travail and time by furnishing selective information on which students further need extra assistance, which teaching exercises are earning the biggest influence and more speedy accomplishment of learning targets by giving learners approach to tools that help them to measure their advancement. These broadens and heighten learner accomplishment and confidence by rendering learners with timely selective information about their operation and that of their equals, as well as proffer suggestions on actions and subject that address identified cognition gaps, this interactive visualization of complex data will give educators and learners the power to focus on data sets, though counting on the demands of a particular learning or teaching circumstances.

#### 3.1.2. Academic Analytics

The higher-level analysis and objective needs of policy makers, senior administrators and government officials can be called Academic analytics. These benefits of academic analytics bettered know-how motion across the organization, for example a standard measure and comparisons with other universities. Also, through heightened insight into components affecting learning accomplishment encourages better decision making and resource allotment which helps cutting-edge detailed information within the organization and made less the costs.

#### 4. Architectural Design

This work is to design a basic structure or system that will contribute to the tools and the data (Information) provide entry to the researchers in the area of advance education and institutional research. The study is improving upon these ideals: Clear design to the appropriate integration and future extension to a primary system that supports structured and unstructured data and mechanism to integrate data (Information) from different sources. Advanced analytics change the breakthrough of new concepts we did not know. Discovery and analysis of data that is likely new to us. Novel data sources generally, which is one reason organizations and companies are analysing, visualizing and exploring big data more than ever before.

Pure data describe operating on advanced analytics, which influences most beneficial with elaborate source data in its master form (Original), using discovery-oriented technologies such as ad hoc queries, search, SQL (natural Language), predictive algorithms and mining processing. The expansion of DWs can bear approximately forms of big data and improved analytics, but the extreme volumes and hefty processing of big data are tugging greater users to locate big data on standalone architecture within a stretched DW environment, basic structure such as Hadoop, NoSQL databases and DW appliances.

Therefore, in this research work, the authors analyse data from, unlike sources so as to gain clear or deep perspective of investment in higher education growth. This work is grounded in the past exploration through a novel implementation utilizing open source. The systematic plan improves education institutions, in both research and educational views, is difficult to analyse because it contains difficult connections, large variables and the potential to turn big data. The Design will have a Built-in complex analytics module; this allows the users to operate speedily. The easy and lightweight independent interface client side with a high level of availability, scalability and flexibility with using cloud provisions. Notwithstanding, analysis of higher education data needs lots different technologies, but also not only prominent mass volumes of multi-structured data sets, specifically Hadoop based system has better technology.

Fig. 1, exemplifies the comprehensive analytics strategy for HED research that sustains multi-structured data sets, serving, analysing and detailed essentially features. The green area shows the comparative structured and unstructured data surrounding condition under the data analysis for Hadoop-based Big Data and relational database management system (RDBMS).

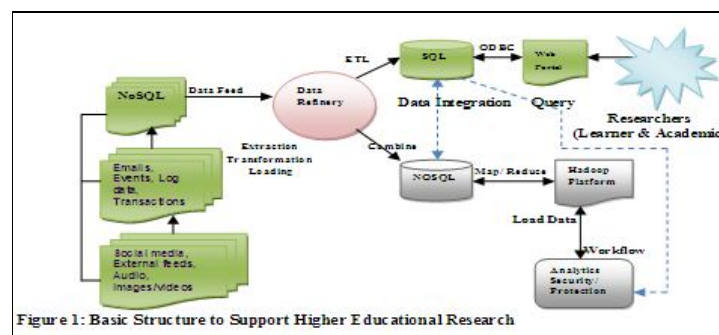


Figure 1

#### 5. Methodology and Analysis

##### 5.1. Objectives of the Study

- To evaluate big data analytics Potentiality and capability in the major organisations.
- To evaluate the various physical magnitude of data collections analytics for organisation.

##### 5.2. Statistical Design

In the study, there are approximately 67 educational institutions, and the data collected from different multiple source are roughly aggregated to 3 GB. Both the analytical exploit increased, and the volume of data, enhanced and runtime of the statistical procedure will take far more time because the process of translating the data into a logical or consistent position for analysis to be performed is challenging and takes time. Consequently, it is important and useful to have a basic structure that could render higher education researchers with a merged opinion of the total data, strong computational tolerance for time consuming and complicated statistical analysis no matter the origins.

##### 5.3. Data Collection and Analysis Tools

The pose of data is to offer access to investigators in the area of advanced education institutional research. The primary data collected was on the ground of questionnaires, which was distributed to respondents in several organizations. The respondent's survey was staffs. While the secondary data was collected from various published reports available nationally or internationally, which includes IBM, EDUCASE, HADOOP, ORACLE, department of education in various Universities and many more.

The analysis is established on several aspects of spiral model, linear progression and regression model, likewise making use of simple percentage and potential relationship have been lent out through cross-sectional study in every place essentially feasible.

##### 5.4. Cognition of Big Data Analytics

- **Hypothesis 1 (H1):** There are major significant differences amongst lager organizations' knowledge of big data analytics.

Big data is not significant until it is, however, put to use to solve important educational research complexity. It commands admittance to the higher degree data of different kinds, as well as potent analytics potentialities that admit both the required skills to use them and software tools. Analysis of those businesses hired significant data activities exposes that they are designed to address structured data with a firm core of analytics potentialities, which is both semi-structured and unstructured forms. According to Fig. 2, the respondents in from more prominent organizations like IT roles seemed much superior communicated about big data analytics than their counterparts who are in education and BI. A substantial ratio of respondents from such organizations (24 per cent) equalled of the view that their know-how in this area was either poor or very poor. Moreover, low levels of cognition were common among staff working in both IT and BI roles.

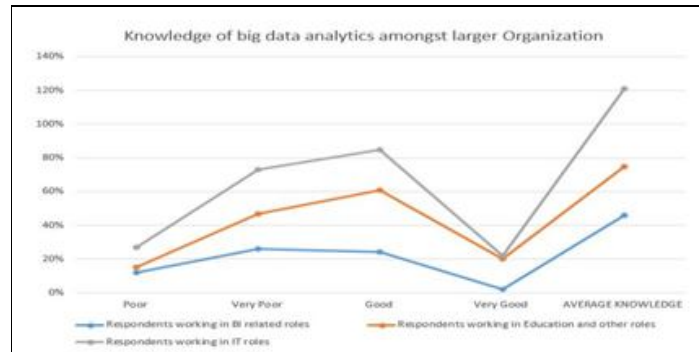


Figure 2: cognition of big data analytics amongst larger firms

Subordinate of cognition appear to be more dominant between organisations controlling the primary sphere, for example, those with less than 420 employees, and those that have not carried out or do not intend to enforce big data analytics.

- **Hypothesis 2 (H2): Applying data analytics capabilities such as streaming, data mining, and e.t.c. Has largest percentage compares to a low percent when using predictive system.**

More than 80 percent of respondents in Learning and Academic analytics in educational organizations with dynamic big data feats described applying core analytics capabilities, such as reporting, data mining and query to examine big data, but 77 percent described using predictive modelling, when it is being stored in a relational database (See Fig. 3). Meanwhile, Introduction of Big data increases with the motivation for more advanced data visualization. Datasets are often voluminous for data analysts or organization to consider and examine with data mining tools and traditional method. In our study, respondents said that 76 percent of dynamic big data efforts bank on data visualization skills. Organizations locked in big data require more and more progress capabilities to determine forms in the underlying complication.

To carry through this, respondents are implementing advance analytics and optimization models and using simulations to examine a large indefinite number variable within big data, to better understand how to transform key organizational processes. Our survey found that more than 60 percent of active big data efforts are using these advanced modelling capabilities.

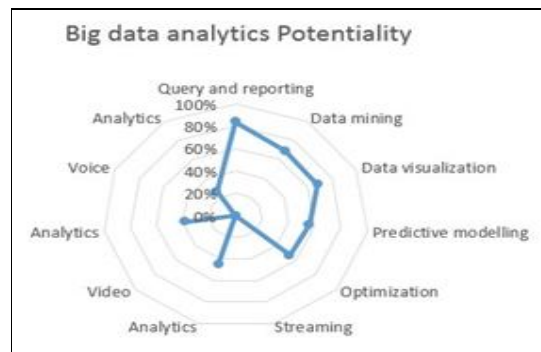


Figure 3: potentials of big data analytics

Each of this data point was collected on an individual base. Having the capabilities to analyse unstructured data, for example voice, video and or streaming data continues to be a problem for most businesses. The software and hardware in these fields are growing, even though the skills are in short supply. Developing these more advanced technical and analytical capabilities calls for big data advancement and progress is turning a lead challenge amidst many companies with dynamic big data crusades.

## 6. Implementation and Future Work

The history of technology adoption in education suggests a consistent and challenging model: important ideas and innovations developed piecemeal and in isolation, resulting in a disintegration and confusion for end users who are most in need of efficient solutions. Several organizations with an interest or concerns in the education system has access to more data than they can manage. In spite of this adequate provision, however, learners, educators, and researcher are essentially driving no visibility

closed at one end. Method and new technologies are expected to gain insight into the complex; abundant data ran across on a day-to-day footing.

Our aimed integrated learning and academic analytics platform attempt to surround the step-by-step work or process of educational innovation by providing an open substructure for learner's, educators, and researchers to develop systematic ways and new technologies. In today's educational Analytics has had the expectation of assisting as a sense making factor in piloting an uncertain change by offering a clear inspection data and analysis, displayed through user-controlled visualizations.

### 7. Acknowledgement

My sincere appreciations to my doctoral committee for their continued support and expression of approval all the time: Prof. Alexander Kostin; Assoc. Prof. Serdar Saydam; Ass. Prof Yasemin Fanaeian. I really do appreciate the guidance for the learning opportunities provided by you all. Without the support of my friends, Acheme, Joshua, Yomi and Johnson, the completion of this project could not have been accomplished, a big thanks to you all.

Finally, to my loving, and supportive wife, Elizabeth Bolanle Fadiya, your encouragement when things got tough are much appreciated and punctually noted. My heartfelt thanks. Thanks to my parents as well.

### 8. References

1. David Nicol and Debra Macfarlane-Dick, "Formative Assessment and Self-Regulated Learning: A Model and Seven Principles of Good Feedback Practice," *Studies in Higher Education*, Volume 31, number 2, 2006, pp. 199-218.
2. James Theroux, "Real-Time Case Method: Analysis of a Second Implementation," *Journal of Education for Business*, July/August, 2009, pp. 367-373.
3. Sharona Levy and Iri Wilensky, "Mining Students' Inquiry Actions for Understanding of Complex Systems," *Computers & Education*, Volume 56, 2011, pp. 556-573.
4. U.S. Department of Education Office of Educational Technology, "Enhancing Teaching and Learning Through Educational Data Mining and Learning Analytics," 2012.
5. Vincent Alevan, Jonathan Sewall, Bruce McLaren, and Kenneth Koedinger, "Rapid Authoring of Intelligent Tutors for Real-World and Experimental Use," Human-Computer Interaction Institute, Pittsburgh, Pennsylvania: Carnegie Mellon University, 2006.
6. Reuters Big Data for Education: Data Mining, Data Analytics ...  
<http://www.brookings.edu/~media/research/files/papers/2012/9/04%20education%20technology%20west/04%20education%20technology%20west.pdf> (accessed April 20, 2014).
7. L. Soares, "The rise of big data in higher education," <http://www.educause.edu/library/resources/rise-big-data-higher-education>, 2012.
8. <http://www.nytimes.com/2012/03/29/technology/new-us-research-will-aim-at-flood-of-digital-data.html>
9. <http://www.whitehouse.gov/sites/default/files/omb/egov/digital-government/digital-government-strategy.pdf>