LEVERAGING ON BIG DATA ANALYTICS FOR SERVICE DELIVERY A PERCEPTION EVALUATION APPROACH

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ABSTRACT: *This investigated and presents drivers impeding the leverage of big data analytics in Nigerian and indeed developing countries in African universities. The main aim was to improve the quality of service delivery system in Nigerian Universities using Big Data Analytics. The methodology adopted random sampling technique and a sample size of 130 respondents made up of staff and students of selected universities in the southeast Nigeria. The collected data were subjected to analysis and results were obtained and interpreted showing that Big Data Analytics is attributed with innovation and efficiency. It gives Universities the opportunity to effectively respond to changes, learn new realities or facts and trends that can and will promote service delivery and efficiency in Nigerian Universities. Finally, paper concluded that Big Data Analytics comes with great prospect and Nigerian Universities should adopt big data analytics in their day to day task and work to overcome challenges associated to it.*

KEYWORDS: Big Data Analytics, Information Use, Students, Teaching, Service Delivery

INTRODUCTION

The role universities play towards enabling individuals to be self-reliant and valuable members of the society at large is very important in ensuring the provision of manpower, promotion of socio-economic development in a country and also development of intellectual capability of an individual and the society. This primary responsibility therefore makes the university system different from any other organization. Therefore, the introduction of Big Data (Modern Technology) in our university educational system can easily guarantee the achievements of these above listed benefits.

To achieve these responsibilities with ease, a modern technology known as Big Data analytics is introduced into our university system. This technology will manage large amount of data that are generated from the university as these data will be needed to go through the critical observation and evaluation from various accreditation agencies or government norms. Various processes like teaching, learning and management of vast data will be improved by this modern technology (Big Data) because these processes will be subjected to verification, observation and accreditation by approved government agencies for efficient performance.

It is therefore necessary to explore new means for improving and monitoring student's success and other institutional policies (Tulasi, 2013). Big Data in Nigeria Universities is an innovative idea and practice that will solve most of the present-day challenges of our universities. It is also one of the future areas of research Tulasi (2013) has the potentials for achieving and promoting educational service delivery which includes services such as advising students, providing guidance and counseling when there is the need and ensure administrative functions are carried out.

Big Data therefore allow for very exciting changes in the educational field that will revolutionize and develop innovative educational strategies like the way students learn and teachers teach (Alonso & Arranz, 2016). It cuts across every aspect of university system such as administration, teaching, and learning.

Big Data Analytics is relevant in addressing a significant number of pressing issues for education systems (Marsh, Maurovich-Horvat & Stevenson, 2014), it is therefore best for universities to leverage on Big Data Analytics to ensure quick delivery in the academic sector and the society at large.

Improvements in the assessment and value of learning results with minimum budget and relationship with students has always been the pressure faced by higher institutions; data collection during students' registration, sourcing for sponsorship and instructional procedure makes this pressure faced by higher institution achievable. Hence, Big Data analytics is relevant in addressing a significant number of pressing issues for education system (Marsh, Maurovich-Horvat & Stevenson, 2014), equipping students with necessary skill for their future career, educator effectiveness increase, delivering education for all that may be tailored for individual learners needs and achieving understanding from learning experiences.

Management of data in the correct way, using and analyzing data has become important due to availability of voluminous data in management department of universities. Big Data and analytics have made it possible to analyze such vast volume of data and evidences for decision making very possible; hence Big Data is not simply indicated by "VOLUME". Indeed, industry, government and academia have long produced massive data sets for example, national censuses (Rob, 2014).

Big Data presents to institutions of higher learning a good framework for efficiently utilizing the vast array of data in shaping the future of higher education that Big Data application in higher education is attributed to technological innovations and developments; which have catalyzed the growth of analytics in higher education (Alonso & Arranz, 2016).

Definition of Big Data

In Universities, Big Data Tools and managing data will make the tedious task of management very easy. In department of any university there is vast volume of data, and managing that data in the proper way as well as using and analyzing the data is also necessary. Many universities find it difficult to manage such a vast data. Analyzing such data and evidences for making decisions will be possible by using Big Data and Analytics (Deepti & Ajit, 2017).

Big Data is used not only for management of vast data but also to leverage it for teaching, learning process which will help students for their improvement. This is the key IT trend that should drive institutional strategy and policy making in future years. This process will help

universities to empower their consumer or stake holders. Analytics performed on the basis of data collected from student information like-financial, enrollment, academic, extracurricular and instructional plays an important role in accomplishing a thorough analysis of students and learning to make better and informed decision on future course selection.

The term "Big Data" refers to any set of data that is so large or so complex that conventional applications are not adequate to process them (Wikipedia, 2015). However, knowing that over 80% of the world's data are currently unstructured (Iyilade, 2015), according to Bill & Mary, (2016), big data covers innovative techniques and technologies for capturing, storing, distributing, managing and analyzing large data sets with different formats. They characterized big data by 6V's; namely, volume, velocity, veracity, variety, verification and value.

Big data refers to data that is too large, complex and dynamic for any conventional data tools to capture, store, manage and analyze. It describes data that is too big and moves too fast, that conventional methods of data analysis cannot handle. It is a typical data lake which holds all forms of data (White, 2015). In reality, big data sizes are a constantly moving target, ranging from a few Terabytes to several Zettabytes of a single data set, depending on the particular context in which the data is used (Jinchuan, Yueguo, Xiaoyong et.al, 2013).

Big Data describes data that is fundamentally too big and moves too fast, thus exceeding the processing capacity of conventional database systems (Manyika, Chui, Brown, et.al, 2011). Big Data present to institutions of higher learning a good framework for efficiently utilizing the vast array of data in shaping the future of higher education. Hence, Big Data application in higher education is attributed to technological innovations and developments; which have catalyzed the growth of analytics in higher education (Alonso & Arranz, 2016).

According to Banica & Radulescu (2015), Big data, in the context of e-Learning systems (also called Big Learning Data), consists in the information sources (courses, modules, experiments etc.) created by the teachers, but especially in data coming from the learners (students) throughout the education process, collected by the Learning Management Systems, social networks, multimedia, as they were defined by the organization or the professionals.

Big data Analytics will provide new model for university leaders to improve teaching and learning processes and will serve as a foundation for changes. Academic analytics has the potential to create actionable intelligence to improve teaching, learning, and student success (Alonso & Arranz, 2016). According to Ben, (2015), Big Data Analytics could be applied to examine student entry on a course assessment, discussion board entries, blog entries or wiki activity, which could generate thousands of transactions per student per course and Big Data can influence higher education practice, from enhancing students experience to improved academic programming, to more effective evidence-based decision making, and to strategic response to changing global trends. However, because Big Data is a new phenomenon in higher education, its conceptual relevance, as well as the opportunities and limitations it might bring, is still unknown.

There has been growing interest in the education community to take advantage of Big Data to improve learning performance of students, enhance working effectiveness of teachers and reducing administrative workload (Schmarzo, 2014). Big Data therefore will ensure delivery to student's learning needs. It is also believed that Big data analytics is a new and welcome expansion in the university system. It is a process of examining large data set for identifying

hidden patterns and other necessary information (Corrin, Kennedy & Barba, 2017). It is capable of processing structured and unstructured data from different sources.

Big data is made up of learning analytics (LA) and academic analytics (AA). Learning analytics deals with data related to learners and their contexts with the primary goal centered on improving student learning. In the same vein, academic analytics is concerned with improving organizational effectiveness through the use of student, academic and institutional data. Assessment for learning is one area in education where big data and analytics are found very useful.

Big Data is the Information asset characterized by such a High Volume, Velocity and Variety to require specific Technology and Analytical Methods for its transformation into Value (De & Greco, 2016), It is categorized into three; (structured, unstructured and semi structured data) and it is generated from diverse sources. Big data therefore is usually composed of datasets with sizes beyond the ability of commonly used software tools, which are unable to capture, curate, manage or process such that within a minimal time (Doulkeridis & Norvag, 2014).

Advantages of Big Data to Nigerian Universities

The following are the advantages that Universities are bound to have if Big Data is fully implemented:

1. Student Course Major Selection: Aligning a student's passions with an appropriate major by analyzing the feelings that they express about their classes on social media and the amount of time they are dedicating to courses (Oracle Enterprise Architecture, 2015).

2. Predicting Student Performance: Big data helps university to predict student's academic performance thereby showing student's IQ on a particular course or task assigned to the student or students. Also, students who will possibly fail at the end of the semester are identified and measures such as instruction, supervision and response mechanism are put in place to help the students.

3. Student Retention: Understanding a student's current sentiment about the institution and their instructors can help the institution take corrective action sooner that will enable retention of the student (Oracle Enterprise Architecture, 2015).

4. Advancement of Students: The reason for inadequate advancement in student's career can be analyzed and addressed. Hence, students with problem of being "AT RISK" not progressing towards early graduation are identified, corrected and motivated.

5. Research Optimization: Big data has continued to transform the university system by making constant innovation and promoting better decisions making, this is as a result of facts obtained from research and knowledge creation thereby making the university system a smart institution for learning and knowledge acquisition.

Application of Big Data

Big Data Analytics cuts across every sector of life such as health, finance, crime, education, banking etc but with respect to Universities, big data is applied in all the sectors such as:

1. Predicting student performance: Big data as a tool is used to predict the performance of students in their academic work and analyze their interaction with other students and teachers in a learning environment. This will go a long way to reduce the rate of drop out in the university system and identify their weaknesses at early stage.

2. Data Visualization: Reports on educational data become more and more complex as educational data grow in size. Data can be visualized using data visualization techniques to easily identify the trends and relations in the data just by looking on the visual reports (Katrina & Loganathan, 2015).

3. Universities can put Big data into use, it can serve as a smart mechanism to provide feedback to student's inputs which will enhance communication and performance among students by limiting traditional method of teaching. The intelligent feedback mechanism will enhance the students learning course content and as well stimulate interactive learning sections

4. Course recommendation: this is one of the primary responsibilities of the course adviser, course advisers in our universities need the knowledge of big data in the discharge of their duty and suggest elective courses for students if properly done, course recommendation will improve student efficiency. Also, Head of Departments can use this knowledge to rightly position the department by recommending courses for lecturers which will promote the integrity of the university

5. Monitoring Students Behavior: It is a known fact that some factors can influence student's behavior; examples are family, friends, religion, interest, habits, and environment. Big data will help us to be alert and serve as the earliest way to monitor and analyze these factors and detect with easy the behavioral trend of a student and know when a student is likely to get involve in different ideologies and principles which may affect him or the society at large.

Motivation

Universities generate huge amount of data/information. This information comes from registration, admission, finance, student academic performance. This generated information if put to effective use will transform our universities and help the system to achieve its primary objective but the fact is that we hardly have access to this information because of inadequate comprehensive database that can provide all these with ease. Big Data Analytics will provide this information. It is a new trend and a moving technology which will promote service delivery in our universities.

CHALLENGES OF BIG DATA TO NIGERIAN UNIVERSITIES

Nigerian University system like its counterparts will also look to the back; to note its strength and weakness and also know how to model the present because of notable challenges. Introducing a new technology comes with challenges; Big data is a modern innovation and has some challenges peculiar to it.

The term "Big Data" is used, therefore, to indicate the challenges related to the appearance of data sets whose size and complexity pushes companies to adopt new data architectures and solutions to manage it. Big Data requires new capabilities to manage and control internal and

external information flows, to transform them into strategic resources able to define positioning strategies that meet the needs of consumers who are increasingly more informed and demanding (Odbms, 2019).

It is obvious that universities have difficulty in determining the best approach to get information or knowledge from the wide data set that is being created and how to ensure that this information gets to the stakeholders such as the administrator, students, lecturers etc. Also, universities in Nigeria are always faced with the problem of poor funding from the government; introducing big data into the university is a capital-intensive project that most universities may not be able or ready to fund the project.

Therefore, Information Technology leaders of institutions should ideally demonstrate the importance of Big Data technologies in their Information Technology strategic plans, in addition to showing how the proposals they present address vital information issues. This can help allay the fear that many big data projects don't have a tangible return on investment (ROI) that can be determined upfront (Gartner, 2017).

Big Data also presents several analytical challenges that demand continual updating of tools and expertise, meaning that institutions need to have sufficient budgets to address these concerns. There also exist legitimate concerns about privacy, especially for data from online sources. This coupled with the digital divide in many nations presents obstacles to harnessing the power of Big Data for the benefit of the users of the educational systems (Dede, Ho, & Mitros, 2016).

Many challenges associated with the handling of Big Data are broadly due to its characterizing properties namely volume, velocity, veracity, variety and value. The challenge is in integrating the heterogeneous data sources and data types in this big data era because the data sources are diverse; for example, there is need to integrate sensors data, cameras data, social media data, and so on and all of which are different in format, byte, binary, string, number, and so forth. Data Analytics requires communication with different types of devices and different systems including a means of extracting data from web pages (Chen, Deng, Wan, et.al, 2015).

Stages of Big Data

The stages of big data are as follows:

1. Collection: this is the gathering from various sources and categorizing relevant data (once) into groups which will help to present the data into a more valuable format. Data collection is the first stage of big data. After the collection, data is transcribed from the source document to a sensible medium thereby ready for analysis.

2. Analysis: this is analyzing facts with respect to the existing system and selecting among competing features. This stage explains the technique and various test employed in the analysis of collected data. The analysis stage is a very complex stage. It is at this stage that data collected will be carefully screened. This process makes use of specialized tools to achieve this objective.

3. Visualization: This intends presenting analyzed data to the user in a form that it will be readable and make sense. (presenting the data in a more readable and accessible format after it has been processed) This will then help the user in decision making and it is seen by most researchers as the final stage of big data.

METHODOLOGY

This research adopts descriptive design. This method was used because it employed random sampling technique which involves collection of data (comprised documented information examples; documentaries, scientific research, browsed materials and written articles) which contains facts about Big data with respect to University system or higher education. Also, Google Scholar was used to increase the scope of the research, data analysis, interpretation and presentation of information collected. The researcher made several visits to Imo State University, interacts with lecturers, HODs, students and the questionnaires were shared and recovered.

RESULTS AND DISCUSSIONS

This deals with the data we obtained from the questionnaire that we shared, explanation and interpretation of our results are also made. These are explained in Figures 1-11 below.
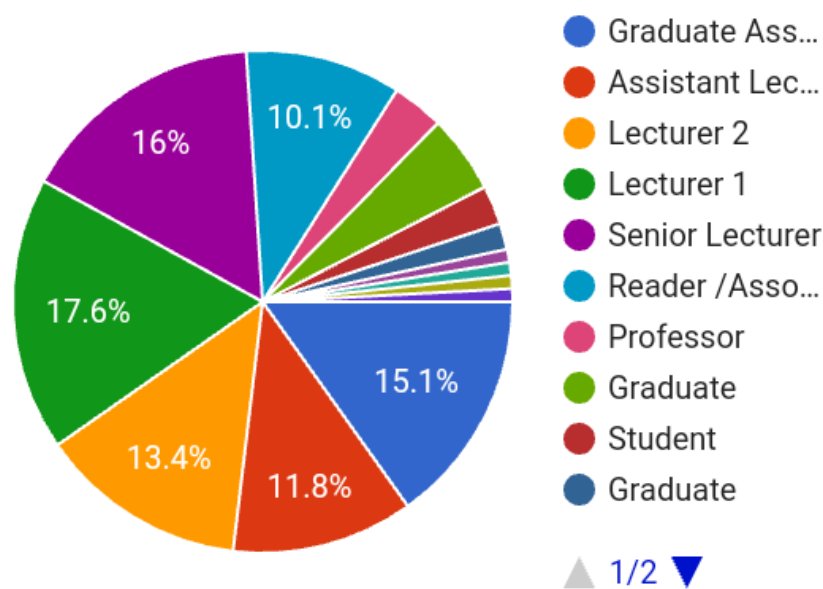
Figure 1: What is Your Position in the University? *(119 Responses)*

Figure 1 above shows the position (Students and Lecturers) in the university that responded. 133 questionnaires were administered; 119 students and lecturers indicated their position. From the chart, 15.1% were graduate assistant, 11.8% (Assistant Lecturer), 13.4% (Lecturer 2), 17.6% (Lecturer 1), 16% (Senior Lecturer) while 10.1% (Reader / Associate Professor).
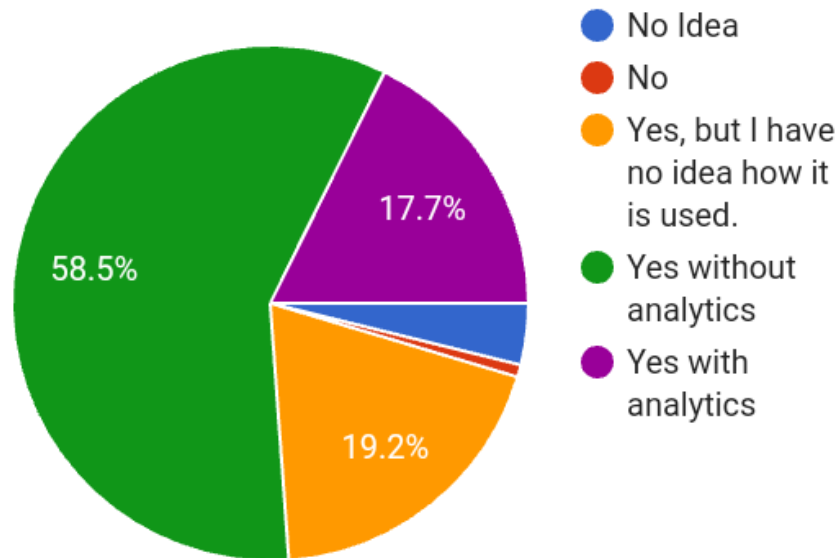
Figure 2: Do You Think Nigerian Universities Generate Big Data? *(130 Responses)*

Figure 2 tried to assess if Nigerian Universities do generate big data. 130 responses were recorded. 58.5% said yes but without analytics, 19.2% said yes but have no idea how it is used, 17.7% said yes with analytics while 4.6% said No idea and No to the question. This result shows that Nigerian Universities generate big data but some don't know how it is been used. This is in agreement with Christos, Vasilis, & Nabil, (2016) that recently, big data and Analytics together have shown promise in promoting different actions in higher education. Also, Athanasios & Panagiotis, (2014) is of the opinion that Big Data has the future to change not just research, but also education.
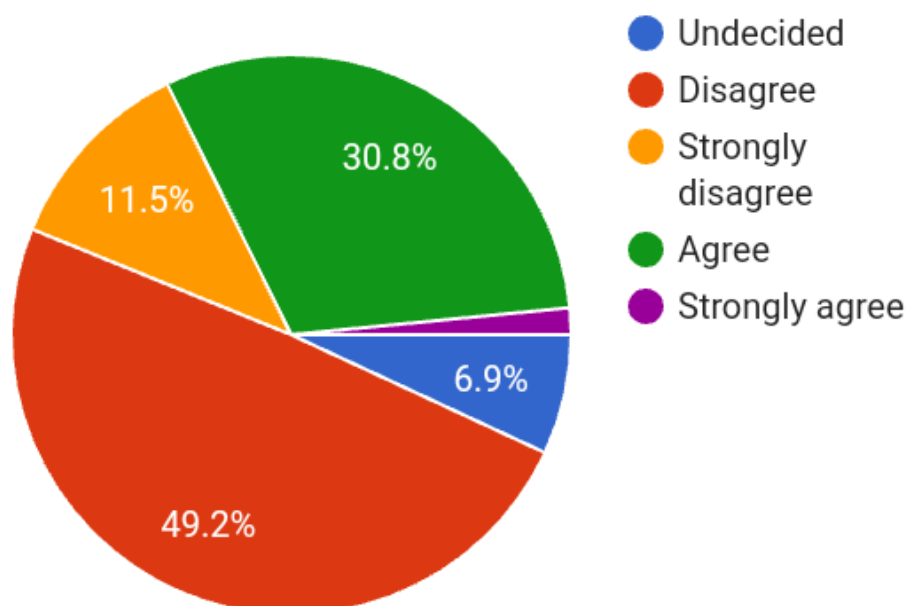
Figure 3: Do You Think Nigerian Universities Use Big Data to Predict Students' Performance? *(130 responses)*

Figure 3 above shows if Nigerian Universities do use big data to predict student's performance. 49.2% indicated Disagree meaning that responders disagree that big data is not used in our universities in predicting student's performance, 11.5% strongly f that big data is not used in predicting student's performance while 30.8% agreed that big data is used in predicting student's performance, finally 1.6% strongly agreed that big data is used in predicting student's performance, while 6.9% made an undecided decision about the use of big data to predict student's performance in Nigerian Universities. From the chart, 60.7% (11.5% and 49.2%) believed that big data is not used in predicting students' performance. This work recommends that big data should be used in predicting student's performance because Ling Dymitr (2015) agreed that Predicting students' academic performance aims to predict how well a student or a group will perform on a learning task. This could provide informed guidance, advice and early feedback that may help to improve student's knowledge retention, formal assessment outcomes and satisfaction from the educational experience (Ling Dymitr, 2015).
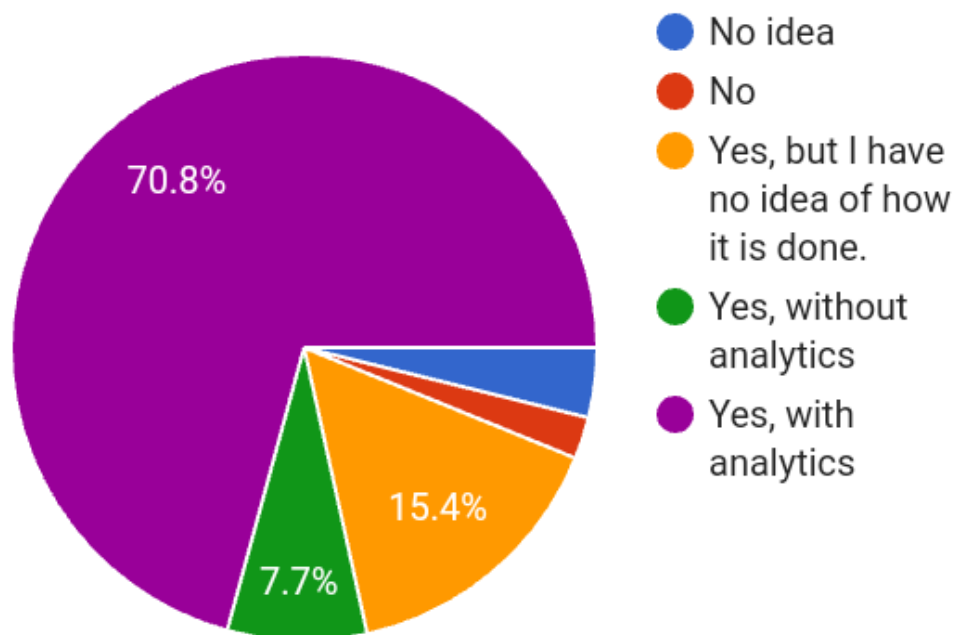

Figure 4: Can Big Data Help in Students' Course Selection? *(130 responses)*

The above figure 4 shows the possibility of big data in aiding students' course selection. 70.8% of the respondents says yes but with analytics, 15.4% said yes as well but have no idea of how it is done, 7.7% also answered yes but without analytics while 6.1% believes that big data can`t help in students' course selection and also have no idea. From the information acquired, 93.9% agrees that big data helps in students' course selection and should be implemented in the Nigerian university system.
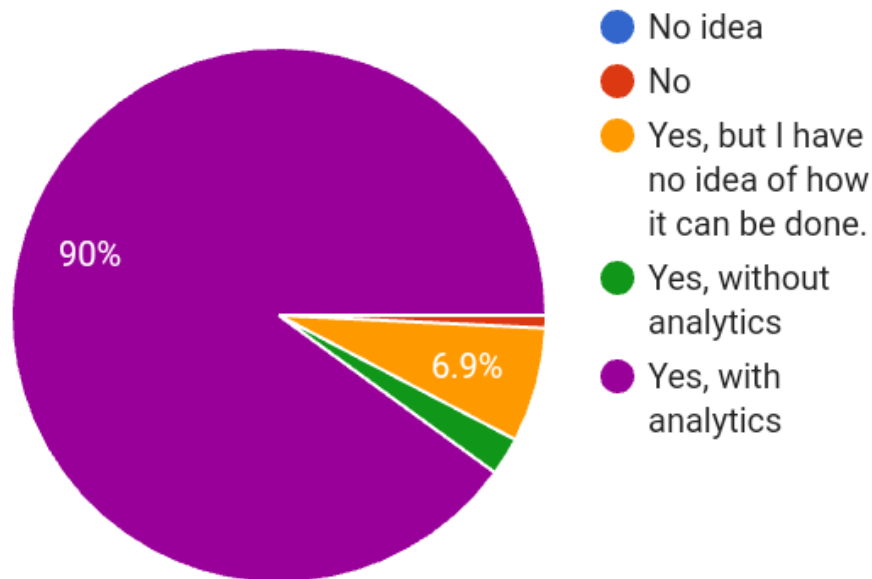
Figure 5: Can Big Data Help to Transform our University into a More Competitive Academic Sector? (*130 responses*)

In figure 5, the consideration on how big data transforms our university into a more competitive academic sector is considered. 90% believes that Big data can transform our University into a more competitive academic sector but with the use of analytics, 6.9% believes same but have no idea of how it can be done, while 3.1% answered no. Hence, having 96.9% accepting the transformation of Nigerian universities into a more competitive academic sector, it is recommended that Nigerian universities should leverage on big data.
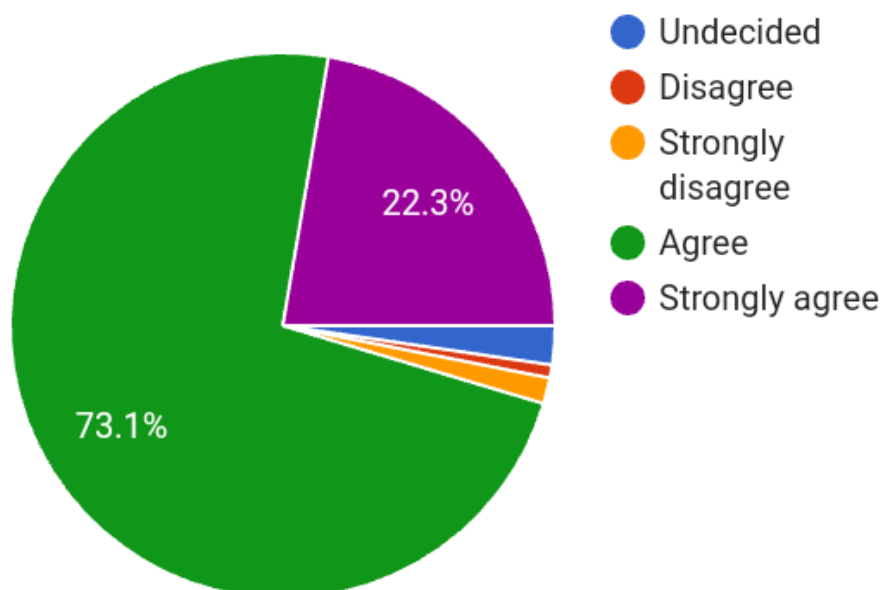

Figure 6: Can Our Universities Afford the Implementation of Big Data? (*130 responses*)

Figure 6 above tries to ascertain if Nigerian Universities can afford the implementation of big data despite the challenge's peculiar to our Universities. 73.1% agreed that our Universities can implement big data while 22.3% strongly agreed that our universities have what it takes to implement big data and gain the advantages attached to it. The implementation of big data will help our universities to meet the needs of students, lecturers and promote service efficiency as well. Banica & Radulescu, (2015) recommend the application of learning analytics for investigating the increasing volume of learner data with the goal of understanding students' activities and behaviors associated with effective learning and using the knowledge to optimize our educational system.
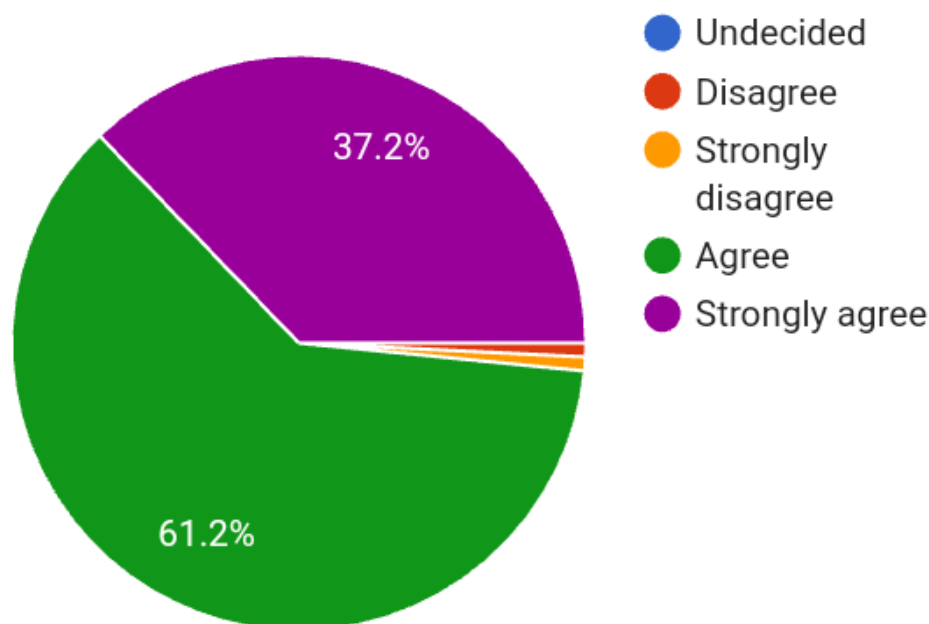

Figure 7: Does Big Data Has a Strong Positive Impact on Research? *(129 Responses)*

Figure 7 above portrays the strong positive impact of big data on research. 61.2% agreed that big data has a strong positive impact on research, 37.2% is of the opinion that big data has strong positive impact on research. Theses impacts are addressing issues related to academic system such that maintain service efficiency among the educators, maintain work load balance and reduce cost involved in building good bond with students. These impacts go beyond student' performance. Also, Universities generate data (structure, unstructured and semi structure) in large volumes, big data will provide university management with raw facts for decision making
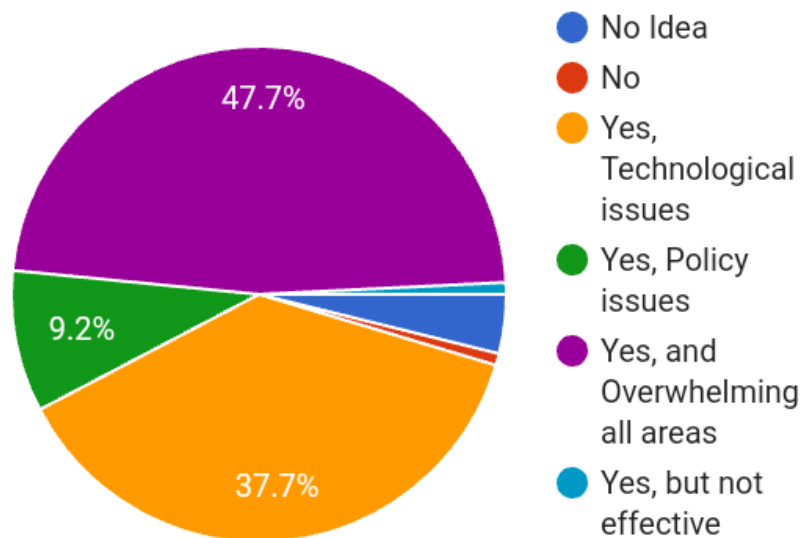
Figure 8: Are There Challenges Associated with Big Data? *(130 Responses)*

Figure 8 depict that there are challenges associated with big data, from the chart, 37.7% said yes that the challenges are due to technological issues, 9.2% said yes that the challenges are due to policy issues and 47.7% said yes that the challenges are overwhelming in all areas. In spite of the prospects of big data in education, higher institutions of learning have to face some challenges to implement big data and analytics in assessment for learning (Christiana, Charles Ogba, et.al, 2019). There is need to address the challenges associated to data such as integration of data from various sources, cost and technology as well. Once these challenges are adequately addressed, the rate of dropouts will be reduced.
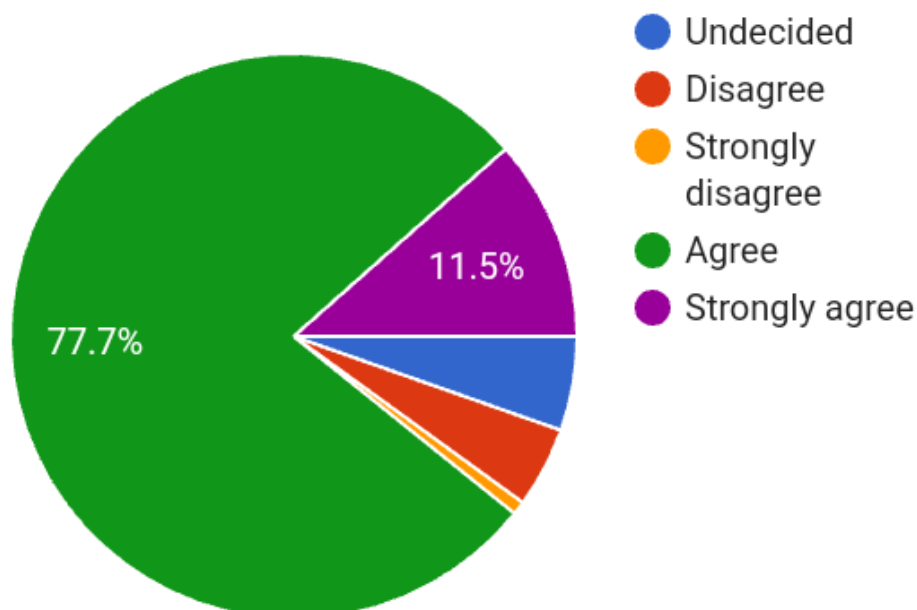

Figure 9: Can Big Data Analytics be used to Capture Students' Behavior? *(130 Responses)*

Figure 9 above verifies if big data can be used to capture student's behavior, from the chart, 77.7% agreed that big data is used to capture students' behavior, 11.5% strongly agreed. Showing that a total number of 89.2% believed that big data is used to capture student's behavior. Capturing student behavior and providing feedback is an interesting area of research. It deals with how and why a student acted or reacted to a particular situation; it is seen as student view of data which is based on pressure from family, friends' habits, environment and peers. The University system generate data in quantum such as personal and academic data. These data captured, stored, processed, analyzed and made readily available and should be accessible for the university system. This mechanism will help the University to monitor students and detect if he is having some challenges and reduce the rate of dropouts.
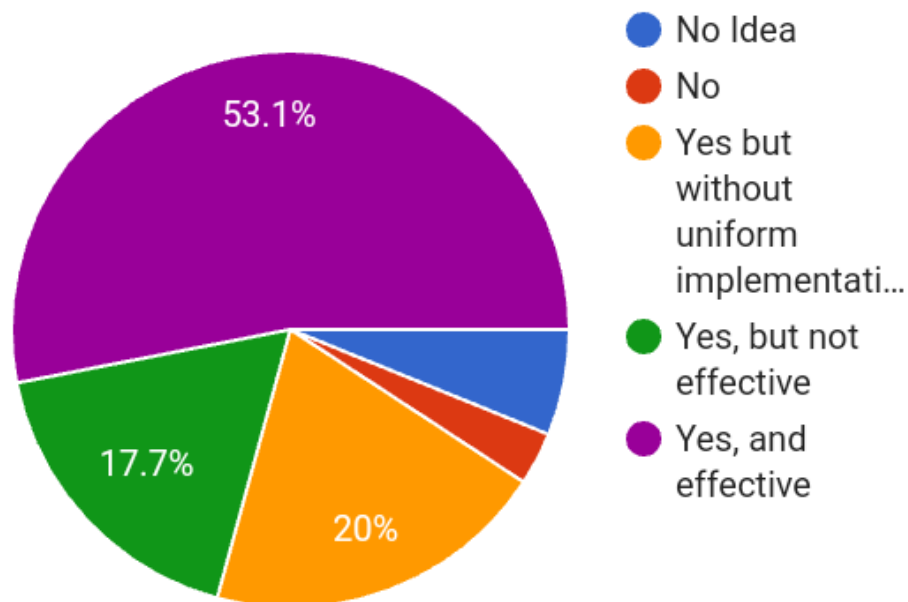

Figure 10: Does Big Data Provide Students with Feedback on the Learning Experience?
(130 Responses)

Figure 10 above shows the percentage of responses that responded to our question. 53.1% said yes and effective that big data can provide students with feedback on the learning experience, 20% said yes but without uniform implementation while 17.7% said yes but not effective. For the feedback mechanism to be effective, it must be structured to have both students and lectures; this is a good approach for effective learning thereby providing students with direction to gain additional, diverse or accurate information.
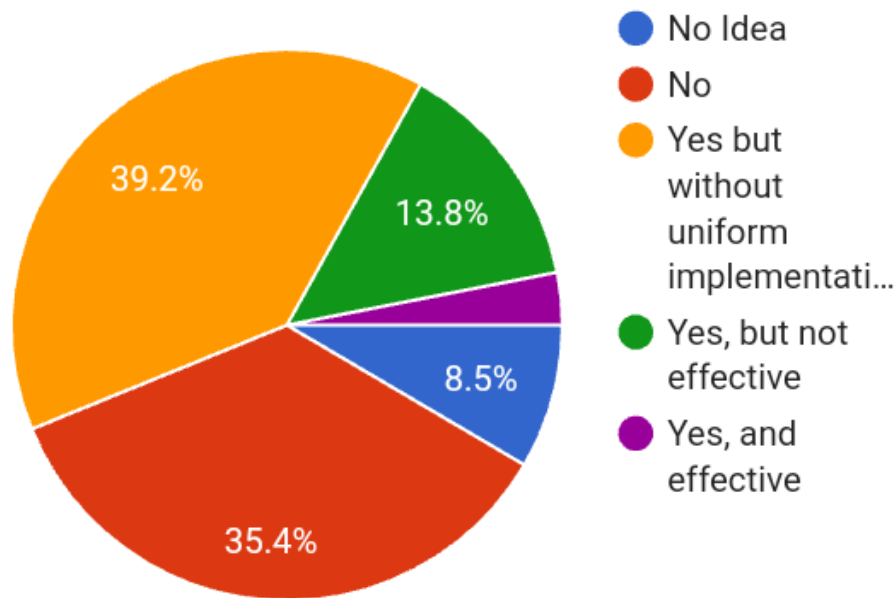
Figure 11: Do You Think Nigerian Universities are Leveraging on Big Data Analytics?
(130 Responses)

Figure 11 above tries to verify if Nigerian Universities do leverage on Big data in their day to day work. 39.2% of the respondents said yes but without uniform implementation, 13.8% said yes but not effective, 8.5% said No idea, while 35.4% said No. From the chart, (39.2% and 13.8%) agreed that Nigerian Universities are leveraging on big data but without uniform implementation and as well not effective. We therefore recommend that Nigerian Universities should leverage on big data because Big data is a modern innovation that is of boundless value and as well can transform our education system, if leveraged on, it will ensure excellence, innovation and service delivery in our universities there by improving the quality of students that will drive the economy one day. In education sector especially the university stakeholder also known as the user, analytics is important and can improve the process of teaching and learning (Khalid, Noor, Mohammed, et.al, 2018).

CONCLUSION

This paper explained Big Data and areas that are relevant to Nigerian Universities. Challenges, advantages and stages of big data were also discussed. Universities in Nigeria are constantly challenged to advance education to a greater height but at a reduced cost and to ensure that quality graduates are produced; this is only achievable when universities will leverage on big data and the technology that comes with it. Big data as a modern technology is used across every sector; presently researchers in the university have noticed and acknowledged the importance and keyed in. University as the center of all research needs big data because of its numerous advantages to the students, lecturers and school management at large.

Acknowledgement

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