Volume: 3 Issues: 12 [June, 2018] pp.1-7
International Journal of Education, Psychology and Counseling
eISSN: 0128-164X
Journal website: www.ijepc.com

AN OVERVIEW OF USING ANALYTICS APPROACH TO PREDICT INTERNET USAGE AND STUDENT PERFORMANCE IN EDUCATION: A PROPOSED PRESCRIPTIVE ANALYTIC APPROACH

Shakiroh Khamis [1]
Azizah Ahmad [2]
Ishola Dada Muraina [3]

[1,2,3] School of Computing, College of Arts & Sciences, Universiti Utara Malaysia, Malaysia

Accepted date: 30 January 2018 **Published date**: 28 June 2018

To cite this document: Khamis, S., Ahmad, A., & Muraina, I. D. (2018). An Overview of Using Analytics Approach to Predict Internet Usage and Student Performance in Education: A Proposed Prescriptive Analytic Approach. *International Journal of Education, Psychology and Counseling, 3 (12)*, 1-7.

Abstract: *For many years, Institution of higher education have been concerned about the quality of education and use different means to analyze and improve the understanding of student success, retention and achievement. Data mining plays an important role in the business world and it helps to the educational institution to predict and make decisions related to the students' academic status. While Big Data analysis has become a keyword in recent years, now prescriptive analytics has taken place in the evolution of data analysis in higher education after the descriptive and predictive. This research focuses on these smarter analytics allow educational decision-makers to detect patterns that exist within the masses of data, project potential outcomes and make intelligent decisions based on those projections. The objective of this paper is to examine the analytics approach by describing the different academic analytics and providing examples of various applications. The paper discusses different definitions of academic analytics to analyze Internet usage and student performance. We propose a Prescriptive Visualization model using the prescriptive analytic approach. The paper will provide a broad overview of big data analytics for researchers and practitioners.*

Keywords: *Academic Performance, Internet Usage, Visualization, Prescriptive Analytics*

Introduction

The past few years have seen an exponential growth in big data analytics and their use in business, banking, human resources and many more (Chen, Chiang & Storey, 2012). This trend is supported and followed by several developments like healthcare, agriculture, services, manufacturing, industry and many more. Now big data has become a major focus in education.

Education remains as a key aspect that has always given emphasis by the government in improving the country's economy, while at the same time ensuring sustained improvement in peoples' general welfare. In fact, all educational institutions across the country consider investments in technology in order to improve student achievement primarily by providing Internet access for students to obtain the necessary information (Class, Wiebke, Friederike and Annika, 2014; Peltzer, Pengpid, & Apidechkul, 2014; Dorji, 2015).). With the use of the Internet is believe to be able to close the achievement gap, improve the quality of learning and improve academic achievement (Johari & Yahya, 2016). While the Internet is known as a facilitator in getting information among students, however, until now it was not proven that the Internet provision can improve student academic achievement (Ramlan & Ahmed, 2010). Therefore, further studies should be conducted to assess the effectiveness of the technologies available to achieve the targeted goals for student achievement in higher education to achieve quality education in years 2020.

Exploring and analyzing vast volumes of data becomes increasingly difficult. Data mining approach is computational tools to extract automatically models or patterns from data whereas visual data mining can help deal with the flood of information for the purpose of decision making (Gandomi & Haider, 2015). With the advancement of intelligent data analysis, the trends and patterns in data can be extracted through the use of data mining technique (Landge et al., 2012). Due to that reason, continuous data analysis became an active field of research and became a major focus in the field of current research.

This paper examines the role of Data Mining Analytics in analyzing Internet usage and their student performance. The paper first identifies the analytic approach in analyzing Internet usage and student performance. Secondly, the paper gives recommendation on the prescriptive analytic approach for continuous research in analytic study. It followed by the Prescriptive Visualization Model for analyzing Internet usage and student performance propose by researcher. The paper concludes by outlining future directions relating to the development and implementation of institutional project on analytic approach.

Literature Review

Analytic Approach to Analyze Internet Usage and Student Performance

Previous studies on the Internet usage and student performance such as those conducted by Sikder, Uddin and Halder (2016), Saeed and Dixit (2015), Kurniawan and Halim (2013) and Mat, Buniyamin, Arsad and Kassim (2013) have completely using descriptive and predictive techniques to evaluate students' performance. This technique will monitor and evaluate the students' Internet usage and student academic performance to investigate to what extent the variable dependencies (Kurniawan & Halim, 2013). Prediction of student academic performance helps organization to explore the relationships between student activities on their Internet usage and their academic performance and an analytic technique that has been used was proven to be a useful result and impact to the organization (Kouatli, 2015). It is obvious by using these two techniques in describe and predict students' performance enable to target intervention across learning process and improve student's success. However, no studies have been carried out on the prescriptive knowledge of students' performance through Internet usage (Mat, Buniyamin, Arsad & Kassim, 2013). Prescriptive knowledge is still lacking in the context of IS research (Seidel & Watson, 2014). It requires the correct tools and approaches to be analyzed and classified effectively and proficiently (Nuaimi, Neyadi, Mohamed, & AlJaroodi, 2015).

Therefore, prescriptive research is needed in the context of the IS discipline and requires a more detailed description and prediction research.

Table 1: Analytic Approach to Analyze Student Performance

No.	Analytic Approach to Analyze Student Performance	
	Author	***Analytic Approach***
1.	Mat, Buniyamin, Arsad & Kassim (2013)	Predictive Analytic
2.	McKay, Miller & Tritz (2012)	Predictive Analytic
3.	Shaukat et al. (2016)	Descriptive Analytic
4.	Devasia, Vinushree & Hegde (2016)	Naïve Bayesian Mining technique
5.	Saa (2016)	Decision Tree and Naïve Bayes

Prescriptive Analytic Approach

Analysis of Big Data helps organizations take advantage of the data and use it to identify new opportunities. With the flood of data available, most organizations turn to analytics solutions to extract meaning from the huge volumes of data to help improve decision making. More recently, prescriptive analytics is relatively new concept to the business planning and advanced analytics space after the descriptive, diagnostic and predictive analytics. It enables to translates a forecast into a feasible plan for the business, and helps users identify the best steps to implement. Prescriptive is widely used in healthcare to recommend alternative treatments to clinicians and patients at the point of care and helping in decision making process (Mathew & Pillai, 2015).

Descriptive analytics is the most common analytic approaches used by many researchers. Predictive analytics analyzes to predict the future while prescriptive analytics suggests decision options with their implication (Song et al., 2013). The current analysis has been explored by researcher goes from predictive to prescriptive analytics (Gartner, 2013). Prescriptive approach designed for normally intelligent people who want to think hard and systematically about some important real problems.

Psychologically, humans generally do not process information and make decisions in an inconsistent manner. With the help of more sophisticated data analysis, it can help to better understand the problems so that they can make better decisions while not guaranteeing the best results. In addition, it is able to provide clear guidance in designing a real (complex) problem solving scheme to adjust to the action taken beforehand so that the decision is really appropriate to run and improve decision quality (Kawas, Squillante, Subramanian, & Varshney, 2013). There is no doubt that descriptive and predictive analytics have been receiving attention for a few years and has been used by many organizations to raise productivity, improve decision making, and gain competitive advantage. This analytic has also proven to provides institutions of higher education to leverage existing data and collect missing data to help make better decisions due to the growing of data.

Gartner (2012) defines prescriptive analytics as "the combination of optimization, rules and data that enhances analytics by suggesting the optimal way to handle a future situation and can be applied to strategic, tactical and operational decisions." In other words, while all analytics approaches aim to improve decision making, only prescriptive analytics recommends (i.e. "prescribes") the best path (Bischhoffshausen et al. 2015; Song et al. 2013). Prescriptive analytics is the final stage in big data analytics which uses optimization and other mathematical models to identify the best actions and decisions (Sanjay & Alamma, 2016).

Prescriptive Analytics is the process that produces answers to the question why something will happen and providing advice to the conditions that are likely to occur in the future (Banerjee, Bandyopadhyay & Acharya, 2013; Bertsimas & Kallus, 2015). Because of this ability prescriptive analytics is needed by top-level management in making decisions. In the process quite difficult to create a system that uses a prescriptive analytics algorithm considering should really be able to see the unseen from the results of two previous analytics (Haas, Maglio, Selinger & Tan, 2011). It is also considering all options for decision making. To accomplish this machine learning certainly is must use.

Prescriptive analysis is the crucial part where data scientists can get insight on the actions needed to be executed to reduce risks and improve the quality of services provided to patients (Wanigarathna, Sherratt, Price & Austin, 2016). However, it not only requires analytic skills and content but needs deployment along with a culture of improvement to show profound results (Crockett, Johnson & Eliason, 2017). By using the same concept, the researcher wanted to apply this concept in the study of Internet usage and wanted to see its impact on the academic performance of the students. In this research will determining new advanced analytic which enables is decision makers to look into the future in the context of higher learning (Basu, 2013).

Prescriptive Visualization Model for Internet Usage and Student Performance

This paper deal with the Big Data Analytic has been used for analyzing Internet usage and their effect on student performances. After analysing the techniques that have been used, researcher come up with the model intended to fulfil the requirement approach. This model will introduce the prescriptive technique that will embed in Decision Support System to analyse Internet usage pattern and the effect to student achievement academically. By applying Prescriptive analytics in the model, it can take data interpretation to the next level. By recommending a course of action, the algorithm can help decision maker make key decisions. An algorithm is not intended to replace human intellect, but it can certainly help people make intelligent decisions.

The model is taken and extends from Knowledge Generation Model developed by Sacha et al (2014) and through combination with Decision making Model developed by Minztberg, Theoret and Raisinghani (1976). From this model, researcher try to add the elements of cognitive and reasoning analytics because the researcher believes the two elements is required to process and interpreting the results of computational analyses and try to reduce the mental load process (Abeysekeraa & Dawson, 2014). The complete model is presented in Figure 1 while in Figure 2 is the process model for integrating this model in Institution of Higher Learning.

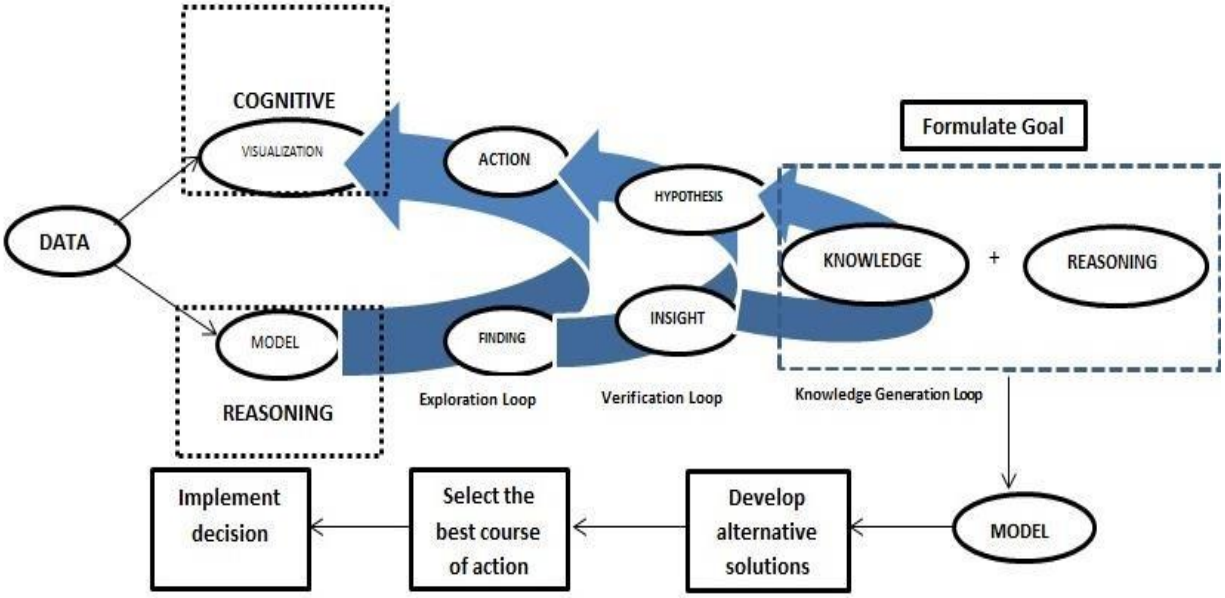

Figure 1: Prescriptive Visualization Model

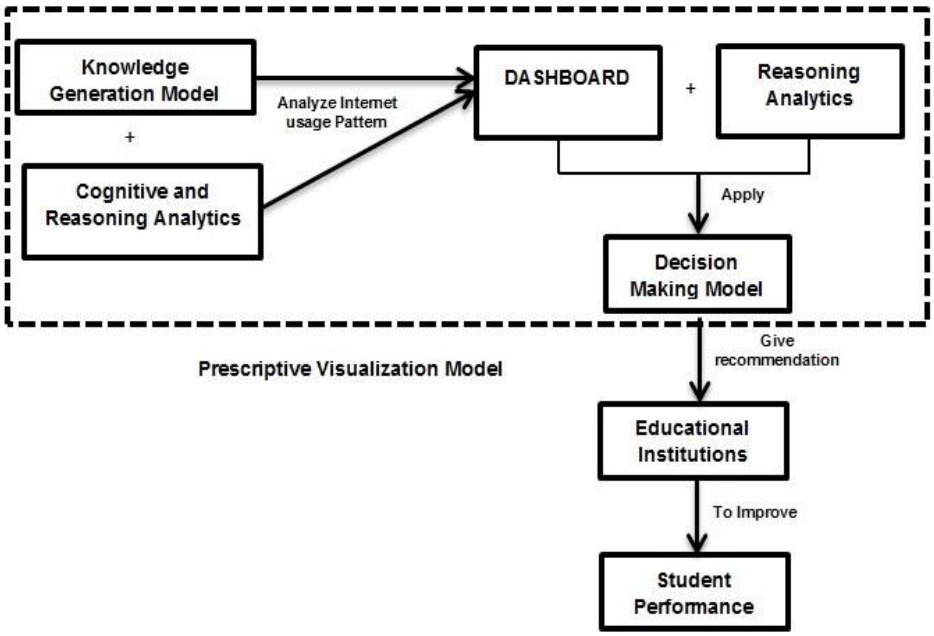

Figure 2: Process Model

Conclusion

This paper has reviewing the analytic approach has been using for analyzing Internet usage and student performance especially for higher education. Researcher try to propose the new analytic approach which is known as Prescriptive analytic as an advanced analytic in the world of big data analytic. It also serves as a future reference for researchers on the domain of analytic and also in education. Besides, this study adds new information to the literature by introducing new approach in the contexts of education. The future study would come up with the prototype to evaluate the effectiveness of this model.

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