An Augmenting of Data Mining Techniques and Algorithms for Academic Measurements and Evaluations

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Abstract
Academic measurement and evaluation are a methodology of testing and proofing the performance and success of learning technology, which is a continual growing and reputation process that provides a better understanding and creation of information societies. It is a dynamic and tactical research-based on the theory of education data exploration processes. It focused on the importance of appropriate teaching-learning process performance measurement for a successful and integrated education system. However, data in the education system and its demand are complex and challenging to extract valuable information. To overcome the problem and minimize information gaps, we proposed Data Mining (DM) techniques to explore educational data. It is a systematic approach to analyze education data as its sources, time serious, and issues. Such heterogeneity of education data analysis is an advanced and integral of DM augmented technology to overcome the challenges and to convert the huge data into valuable information and knowledge. The outcome of the paper is the integrity of advanced analytical and computational technology in to education systems, which underlying the technical lmatter of the sector based on education success and service evaluation. It can be inferredby the educational specialist, students and teachers in the sector how it can be integrated and maximized using advanced technology, via Data Mining.

***Key words**: Data mining, algorithms, education performance, academic measurement, evaluation*

1. Introduction

The integration of learning technologies in a various educational level and systems are promoted and supported by a dynamic and advanced academic performance measurements and evaluations. The technique leads to enhanced learning outcomes (Karen et al., 2012). However, research on the impacts of academic measurements and evaluations are more subjective and depending on human perceptions. In the modern education system, such dynamic learning process and performance evaluation explored based on advanced analytic tools, such as Data Mining (DM). The methods what education industry use might be the better way and since it has no a mathematical formulations factorized perception leads the truth. DM technique can make it clear and interactive by developing data patterns for further knowledge and wisdom extraction (Baradwaj & Saurabh, 2011). Since, learning process or technology itself is a human cognitive processing, which can be characterized as human perceptions, thinking, creative and others to make simple and interactive life. The perceptions varied with respect to “what” and “how” components. The “what” component concerned perception of what constitutes a technology. The “how” component concerned perception of how the technology impacted on learning. Thus, augmenting such a dynamic exploratory tool for academic measurement is a systematic way of optimizations of education facilities and students achievements, which can lead to the successful integrated education system. For teachers also holding the techniques as professional development is proposed in how learning technologies can be used to encourage enhanced learning outcomes (Trinkle, 2005).

Education measurement is coined to knowledge as the succinctly conveys the critical role of educations. This scientific understanding gained by delves exploration of education data using DM techniques, which support to drive more proper predictions and evaluation.DM for education is a fundamental tool to

assess or measure its effectiveness, learning and teaching facilities and techniques. It provides a clear understanding to develop 'smart', interactive learning materials (Barker & Campbell, 2010).It is a philosophy of education data and technology to solve performance measuring subjectivities and challenges, which support a clear understood of a changing world and new ways to share their findings with others. DM technique is an integral maximization of education modernity about the efficiency of the education research.It is asemantical way of unlock the door to a more technological learning experience, which will motivate young people to study and better equip them for life beyond the classroom.Moreover, it helps to ensure education industry has a workforce with the skills required to succeed in today's highly competitive globalized economy (Pratiba & Shobha, 2014). The domain or education is also a prominent cultural institution used to perpetuate the prevailing values of the society and modernization. Advanced or modern education system has a sordid past largely rooted in industrialism. Its aim is to produce economically viable employable citizens. Nearly all our tweaks to the system in the last long years simply attempt to ensure that the graduates are prepared for the workforce (Azlinah et al., 2008).

Nutshell, DM for education measurement and evaluation is a tool to increase in speed and feasibility to the benefit of making replication much more existing data analysis and pattern developments. However, education data are complex, heterogeneous and sensitive (Carr-Chellman et al., 2000). It needs a technique that allows analyzing education large-scale data in its multiple levels of meaningful hierarchy, nature and level of users. It is the issue of how education data analyze as keeping its privacy? What technique is capable and scalable to develop or initiate proper education measurements? How academic measurement is subjective? What is the need of DM algorithms to analyze education measurement and it repercussion? For such challenges and a federated educational data demand integrated approach that can be adaptive and scalable. In the education system, the phenomenon and technology of big data is also highly reflective of education data type and characteristics (data deluge).Therefore, to support the existing academic measurements and evaluation and also integrate with the modern technology, endorsing advanced application tools such as data mining, machining learning, language processing, etc. are paramount. In this paper, we proposed these matured tools to optimize the measurements by exploring the ever-growing educational data. These analytic tools highly adopted in other domain such as businesses and engineering, which can have a great impact on education data analysis for a better of students' creativity, performances and outcomes.

This paper is organized as in section 2 we discussed the facts and advancement of DM for educational technologies related works. In section 3 we discussed DM for education or academic measurement and evaluations. In this section, we investigate and introduced novel ideas about educational data discriminations, the promising of DM for educations, its application, and importance. In section 4 we discussed DM application and its features in theeducation system. In section 5, we summarized the study and revealed the importance of the paper, which followed by the acknowledgments of the supporters of the paper and list of cited references.

2. Related works

DM method is considered as the most suitable technology in giving more insight into educational entities, including student, teacher, administrators, other communities (Baradwaj & Saurabh, 2011; Merceron, 2005). It serves as an active automated assistant in supporting academic measurements to make better decisions on their educational activities to improve decision-making processes in theteaching-learning process. This improvement would carry many advantages, such as increasing student's promotion, retention and transition rate, educational improvement ratio, student's success,

student's learning outcome, maximizing educational system efficiency, etc. More than that by exploring the trend data, it gives a clear understanding of the development of academic measurement standards. Also to these, capable schools and institutes are looking for ways to adapt using DM to build information society (Abdous et al., 2012; Carr-Chellman et al., 2000). The domains know that students will seek opportunities that allow them to cross borders and boundaries in learning virtually. It supports beyond teaching-learning activity, such as administrators, understand DM to administer budgets and student services to ensure transparency, better distribution of resources and identification of at-risk students (Otobo et al., 2013).

Academic or learner measurement and analytics have received significant attention within the modern education system. It gains much interest to trace the research work in the domain for the better of educational performance and students achievements. Educational data analysis using DM tools are paramount to support the system by gaining a clear understanding of the applications for the implementation of student courses schedules and allocation at each level. Since education geared towards the fulfillment of the individual's curiosity, intelligence, soul and interest (Naeimeh & Somnuk, 2008). It is extremely important in growing the individual in many different ways. The outcomes of DM analyzes fostering education services to optimize its services, performances, developing proper academic measurements, cost minimization, etc. Therefore, DM for education is a fundamental analytic tools and technology to solve various educational problems.

DM for education is computational and mathematical methodology, which aimed at creating better learners or students at each level and increasing student's knowledge of the world around them. While primary skills are important, other skills such as critical thinking should be taught from a very young age by developing analytic thinking (Hrabowski et al., 2011). The humanities should be stressed, and material shouldn't taught for the purpose of regurgitation on tests, it should be discussed and analyzed using the collected and stored data. Data from diverse repositories having broadly similar learning experiences (such as using the same learning software).However, in very different contexts, gives leverage that was never before possible, for studying the influence of contextual factors on learning and learners.Education data is a historic or trend data, which is difficult to analyze using traditional methods to visualize the gap between teachers and classroom cohorts. It influences specific aspects of the learning experience, which involves the sort of analysis that becomes much easier with EDM (Zhou & Winne, 2012).Similarly, the concrete impacts of individual differences have been difficult to statistical methods. The analysis with traditional methods is more focusing on case studies, which is a basic ground to augmenting DM to extend a much wider toolset to the analysis of important questions about individual differences.

3. Augmenting data mining for academic measurements and evaluations

Augmenting DM for education system places great emphasis on measurement– grades, national averages, teacher performance, etc. It is a systematic approach to search a solution for years to analyze things such as standardized tests challenges (Arnold & Kimberly, 2010). For example, in mining data about how students choose to use educational software, it may be worthwhile to consider data at the keystroke, answer, session, student, classroom, and school levels simultaneously. Issues of time, sequence, and context also play important roles in the study of educational records block mining model as it is shown in fig.1. EDM is a big potential domain, which emerges as an independent research area. It gives tremendous advantages, including a clear insight and understanding about laboratory experiments, in-vivo experiments, and design research, to make educational data to be feasible and others (Campbell et al., 2007). The data such diverse sources are often valid for the performance and

learning of genuine students, in genuine educational settings, involved in authentic learning tasks, etc. It increases a rapid access and begins with research balancing feasibility with education demographic validity is often a difficult challenge for researchers in other educational research paradigms. These analyzes tend to focus on a measurement of what has been learned and how that compares to a larger population, all of which is important when evaluating students (Yas, 2011). Imagine a system that provides teachers with real-time insights to understand how a student is performing. The teacher can then use the data to spot weak areas and adjust the lesson plan accordingly. This type of tailored instruction can greatly improve student performance (Merceron & Yacef, 2008).

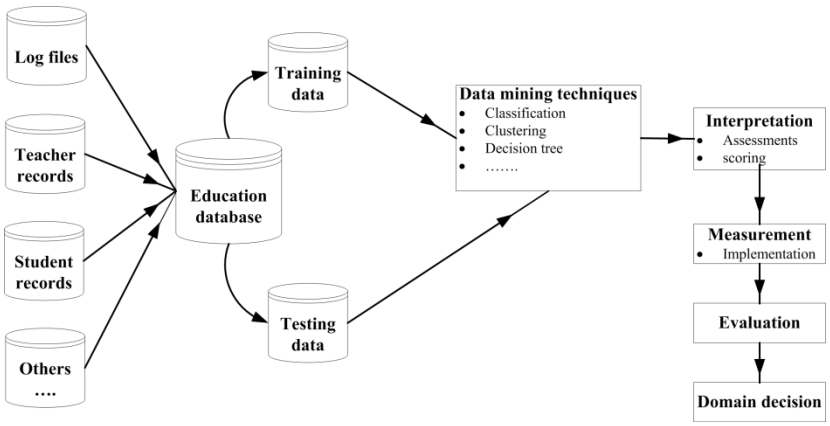

Figure 1: Educational data mining models

Education data need a clear understanding of the domain attribute behaviors. It begins with the education system, and teaching-learning activity records formats and contents, which gives a clear insight the domain and the knowledge content. It is not as such a simple uptake knowledge and use it to "compete" with some letter-grade "lab war" contrived in centuries past as it showed above (fig.2). However, it is the nourishment that changes our very capacity as we avail ourselves of understanding of the domain and applications how to handle and explore education data. If we are all "works in progress" experiencing different growth spurts in capacity, the entire model of "competition totality" becomes systematized dysfunction. To analyze educational data using classical exploratory tools is time-consuming steps, complex, long and narrows computational process. In such a case, the measurement and evaluations of education performance and achievements more challenging because of lack of delve synthesizing and understanding the data (Norris et al., 2008). DM for educational measurement and evaluation serves as a method of recruitment of schools, teachers, and students, scheduling of studies, and data entries. It implies using the current and trend data analysis and modeling, which can infer student attributes (such as strategic behavior and motivation) from the type of data in education databases.

3.1 Data mining augmenting methodological framework

The DM techniques are dynamic and scalable to handle and analyze supervised and unsupervised education data to discriminate and course management system events, as well as student academic performance. It helps to define the gaps between good standing and that are not doing well students using classification and clustering DM algorithms. The mining framework involves teachers and students' perceptions data, learning process, and the analytic outcomes by using or analyzing sample or test data. The DM techniques give tremendous advantages to optimize academic measurements and evaluation. It

gives a clear understanding and roadmap to handle, store and analyze educational data towards performance evaluations. The approach is essential for investigating the requirements for successful integration of learning technologies into measurement systems. Students' creativity and motivations are fundamental to gain the success of integration, specifically the amount of technology use, the ways in which the technology used to learn and their expectations about learning. Educational measurement focused data analysis is a systematic implementation of DM techniques for teachers' and students' perceptions of teaching and learning contexts established a series of systematic associations linking teachers' perceptions and approaches with students' perceptions as it is shown in fig.1 learning approaches and outcomes (Van et al., 2012; Trinkle, 2005). An explanation of these associations is important to understanding the significance of investigating teachers' perceptions of learning technologies.

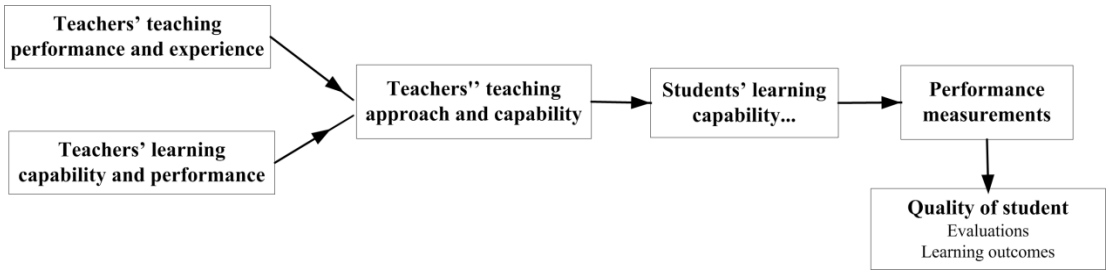

Figure 2: DM based teacher-student educational perceptions and quality of learning measurement framework

As it is shown in fig.2, students' approaches to learning are related to their teachers' approaches to teaching. Teachers who describe using a conceptual change/student-focused teaching approach are more likely to be teaching students who report using a deep approach to learning. Deep learning approaches have the intention to seek meaning in learning situations through linking aspects of the content (Dervis & Ibrahim, 2002). DM technique is playing an essential role by visualizing the key factors between the two associations, which provide a clear understanding to the teach-learning interaction as the students' capability. It also helps to develop a standard to the academic measure towards students-course associations and performance optimizations, which enhance the future education modernizations. As Baradwaj & Saurabh (2011) discussed, DM based empirical studies on deep learning approaches have been found to be strongly associated with conceptual change learning outcomes. In contrast, Trinkle (2005) showed that teachers who describe using an information transfer/teacher-centered teaching approach are more likely to be teaching students who report using surface learning approaches. Augmenting DM technique is a scale-up of these methodologies and an integrated way that help the system by developing a generic performance measuring standards.

3.2 DM based teaching-learning process and measurement standards

The learning context provided by a teacher is the practical implementation of the teacher's perceptions of learning and teaching, and approach to teaching. Students have been found to vary their learning approach in response to certain factors they perceive in the learning context. Students using deep learning approaches are more likely to value independence in learning, good teaching and clear learning goals, factors consistent with a student-centered teaching approach. Students using surface learning approaches are more likely to have different values, and, consequently different outcomes. The data collected as the teaching-learning process is vitally important to analyze using the DM techniques. Such

analytic outcomes implemented to various academic performance optimizations. The EDM analyzes are being replicated across data from several learning systems or contexts to automate student assessment tool that combines their perceptional analytics to performance measurements. It not only grades exams faster, but also extracts student performance measurements and creates real-time feedback for teachers (Hattie & Timperley, 2007). It gives the teachers' ability to address quickly the reality that students learn concepts at different paces and in different ways, which support to customize their teaching, so individually or in small groups, students get the extra attention they need to achieve. Instead of spending time scoring tests and making sense of the data, teachers can quickly access relevant views of the data and focus on meeting the needs of each student.

The successful integration of learning technologies leading to enhanced learning outcomes is unlikely unless teachers 'performance and use technology as an integral part of a student-centered/conceptual change teaching approach. Only through students capability learning technologies as part of a learning context that encourages independence in learning and deep learning approaches are enhanced learning outcomes likely (Honeyet al, 2000). DM is playing a supportive role of educational data handling, analysis, and being promising to revolutionize modern learning systems. Based on these facts, the academic measurements are also clear and implementable as the domain facilities to improve learning outcomes for individual students. Based on the outcomes develop a curriculum at every level of the student learning process that can address student needs. It includes customized modules, assignments, feedback and learning trees in the curriculum that will promote better learning.Imagine how such knowledge can be used to give instructors the necessary intelligence to address directly a student's learning style or deficits. In this way, DM can amplify factors that contribute to student success – personalized courses, the instructor-student connection and a wired sense of community – despite being in the detached online learning environment.

3.3 DM based measurement processing and standards

The measurement of students' learning processes using DM techniques provides deep understanding student performance observations about what students do in the task as well as capture the context surrounding the behavior. The mining techniques are advanced in how such data are conceptualized, in storing and accessing.The techniques that give the capability to discover patterns from large-scale data are spurring innovative uses for assessment and instructional purposes as showed on fig.3.The significant of advanced exploratory tool is to resolve the challenge of academic measurement, which helps to improve learning via individualized instruction (Merceron& Yacef, 2008). Thus, DM based academic analytical process exists on a continuum of data and information, in which transformed by the story that tell about the domain performance and success. This transformation of information results from questions asked about the data that are captured and reported in the education system. By having clear and interpreted DM outcomes, predictions are made based on various indicators. The challenge for analyzing education data towards academic measurement and evaluation is the nature of the data, such as demographic data, which DM method is capable to avoid such risks. For example, student evaluation based on a very little information or incomplete data will make difficult for educators and administrators how to level the student performances. It demands DM techniques to handle such a complex or noisy education data. It is a systematic way to be a solution to the demand forlearners, educators, and administrators challenge the expectations of the traditional and conventional classroom delivery.

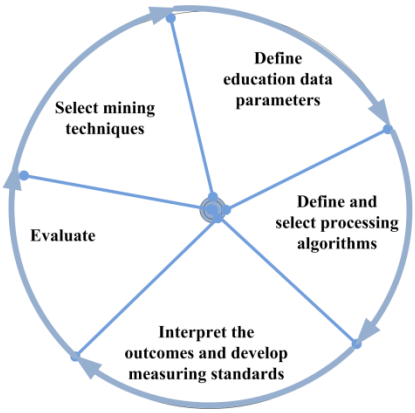

Figure 3: DM based academic measurement instruction sequences

The techniques of DM need to make the education data based analytics to develop a modern education system that are effective for meaningful, measurable, and monitored education system. Education decision that related to teaching-learning process aims in the context of an overall educational strategic plan, which support to discover success and effective learners. It is the serious process of academic activities, which involves academic decisions, implementation, measurement, and evaluation. For a clear understanding of the process, EDM based assessment and evaluation of academic performance are major tasks to carry on data analysis of the student, course, program, and other levels. The underlying algorithms and parameters that drive data collection and reporting can be modified to refine the academic measurement strategy focus to establish and enact interventions of education performance as needed (Romero et al., 2008). The data explored using mining techniques to identify and describe technologies and methods, which used, analyze and evaluate the impact of teaching-learning integrated into education performance and measurements.

4 Application of data mining for modern education analytics and discussions

DM has a big potential to create a great hope to transform education. It is capable of tracks interaction and direct feedback between learners and teachers performance measurement, continuous monitoring of progress and attendance, more opportunities for personalized learning and guided pathways to the students' interests. The users generate all kinds of data, and from those choices, they can be taken from one activity to the next. It is the learning analytics factor of DM methods, which can guide the students and teachers to understand better the trajectory of the learner's progress. The technique needs to adapt the learner's understanding of a subject, analyze students' social relationship and network. It is a systematic approach to evaluate the quality of the learner's input (Thomas & Nora, 2004). At the macro level, the analysis of this data can contribute to sound policy development by providing access to numerous factors from the environments, approaches, and pedagogies that bring about actual results. The techniques of DM is also promising to understand how people learn and how learning occurs or success, which support to design modern educational platforms and tools that can simultaneously analyze the students' behavioral and learning patterns. The need of DM for Education can be discriminated in various performance indicators that employ as an input, process and output levels as summarized in Table.1.

Table 1:The need of augmenting DM for academic measurements

No.	Performance indicators	objective	Mining method	Acquired knowledge	Teaching-learning process	Measuring process
1	Input indicator	Having good records	Education database	The pattern of trend data	Define parameters	Select indicators
2		Preprocessing education data	Cleaned data	The pattern of education trend data in its respective sources		Course measurement
3		Creating meaningful learning environments	DM techniques	Pattern development on student learning process		
4	Process indicator	Develop institutional measuring standards	"	Pattern of mined data	Evaluation	
5		Processing intervention, how to measure …	"	The success of pattern development (as expected)		Student performance assessment
6		Predicting and clustering the process	"	"		
7		Predicting student performance	"	Classified pattern of analyzed data		
8	Output indicator	Improving student quality	"	Interpreting and characterizing the pattern data towards student performances	Counseling	developing standards

Therefore, the techniques of DM are pertinent as to improve student models that provide detailed information about a student's characteristics or states, such as knowledge, motivation, metacognition, and attitudes. Modeling the individual differences between students capability to respond to those individual differences, this is a key theme in educational performance measurements and evaluations research. The approaches of education data analysis, different methods bring different prior knowledge to the process. In the last few years, EDM methods have enabled considerable expansion in the sophistication of student activities. The studies about academic measurement give a clear understanding of the need of education data analysis in which constituted as a relation between individual performances and the data outcomes. What is important, however, is that the findings are described and illustrated in a manner which scalable to the issues and the students characteristics. Since EDM methods have enabled researchers to make higher-level inferences about students' behavior, such as when a student is successive and where did not. Moreover, DM for education is pertinent to discover or improve the knowledge system of the domain, which provide a rapid discovering accurate domain models directly from data.

5 Conclusion

DM techniques based academic analytic provide a detailed description of the education methodologies towards measurement and evaluations, which helps to develop a modern and successive education systems or platforms. The power of DM lies to allow users to consider data from a variety of perspectives to discover apparent or hidden patterns academic measurements. This research derives its motivation from the need of augmenting DM techniques to academic measurements that can be used in practical settings to predict academic performance and carry out early detection of students at risk. The techniques presented in this paper are essential to develop an education data analytic framework for academic success. DM plays a supportive role to present the real facts in the data that tells about the real matter of the students' performance and future academic contents about teachers' perceptions and teaching-learning interactions. It is a systematic way of advancing education communities understanding about the content of their sector data about academic measurement and evaluation. It is an emerging and augmenting analytic technology into the field by investigating the impact that engagement in a teaching-learning process. Further research involving teachers' perceptions of learning technologies is warranted in some areas. The impact of relevant professional development programs on experienced teachers' performance of learning technologies could be assessed. Investigation of the interactions in classrooms between students, teachers and technology is vitally essential to achieve modern education systems. The investigation is also pertinent to the analysis of the impact of academic measurement and evaluation towards student creativity and achievements.

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