

Investigating Factors Affecting the Learning Process in Higher Education - A Case Study

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Abstract — *Globalization, Information and Communication Technology (ICT) advances, and the expansion in Higher Education (HE) pose many challenges on HE Institutions (HEIs). Chief among them is gaining a competitive advantage necessary for sustainability, achieving goals and providing a service that satisfies customers (students). Learning is the most important service provided by HEIs, and it involves two other stakeholders in addition to the institutions, namely, students and educators. The aim of this study is to identify the main factors that affect the learning process at HEIs and to empirically investigate their effectiveness. Content analysis techniques and exploratory interviews were used in identifying main factors and their associated variables. Data mining was utilized for analysis to discover patterns and extract valuable information. The case study involves students from the College of Computer Science and Information Technology (CSIT) at Sudan University of Science and Technology (SUST). A survey instrument was used to gauge stakeholders' perception and expectation of the effect of the predetermined factors. The results showed that many factors have an adverse impact on the learning process and require attention, including transportation, ICT support, and services such as cafeteria and health services, etc. This research contends that identifying and highlighting the effect of factors from the perspective of the main "customers" would yield better students' satisfaction, reduced dropout rates, enhanced HEIs competitiveness and eventually improved learning process.*

Keywords — *Learning process, higher education, ICT, decision-making, data mining, clustering.*

I. INTRODUCTION

Education is defined as a learning process for the individual to attain knowledge. It is an important process for individuals and society since it contributes to the progress and development of societies [1], [2]. No society can advance and become more civilized without education. The culture and values of any society depend on the education of individuals as cultural values are passed on through educational institutions. Generally, the formal educational process is composed of the following stages, kindergarten, primary, middle, secondary and

the HE stage. HEIs deal with post-secondary level of education, and this includes undergraduate and postgraduate colleges, universities and centers.

Numerous research [3], [4] has shown that the core functions of HEIs are: education, research and contributing to the society. In addition, they play a vital role of supplier to the labor market, as they provide highly qualified human resources. Learning is the most important process in HEIs, and it involves three main stakeholders, students, educators, and institutions.

HEIs currently face a variety of challenges, as the spread of ICT and globalization has unlatched international competition in addition to the local one. Moreover, the surge in the number of students without financial support from governments, and the expansion in HEIs both locally and globally. Confronting these challenges requires strategic and tactical planning by HEIs as they must maintain their existing students and stay competitive in recruitment by providing a service that satisfies their customers (students). HEIs must also respond to and stay in-line with the continuous changes in the labor market. Focusing on learning and how this service can be provided in a modern, efficient, and satisfactory to students will make HEIs more competitive.

Innovations in ICT have enabled HEIs to better respond to their growing challenges and achieve their objectives. Currently, almost all HEIs utilize ICT in different capacities to support students' operations, HE management, administrative operations, and planning. Many research articles [5], [6] were published in recent years on improving the learning process in HEIs. Similarly, there are several studies on the use of data analysis including data mining techniques in supporting decision-making at HEIs [7], [8], [9], [10]. This paper combines these two research areas by utilizing data mining techniques to enhance the learning process.

To improve the learning process, first, an identification and examination of the factors affecting its success must be carried out. Followed by an investigation of stakeholders' perception. From the previous discussion, the following research questions arise: what are the main factors that affect the learning process? How can HEIs improve the

learning process? This study’s objective is to identify and evaluate the factors that influence the learning process from the perspective of students. The study focuses on students because they are the main stakeholders and their satisfaction is the target of HEIs. For this purpose, a survey instrument was administered to CSIT students at SUST in a classroom setting.

In order to deliver a meaningful analysis, data mining clustering techniques were applied to provide further knowledge beyond the data [11], [12]. The aim is to discover structure inside unstructured data, extract meaning from noisy data, discover patterns in apparently random data, and use all this information to better understand trends, patterns, correlations, and ultimately predict students’ behavior.

The paper is organized in five sections beginning with this introduction. The following section presents background information about learning, the learning process, and data mining. The next section outlines the research methodology utilized to identify factors affecting the learning process, creating a survey instrument, and the analysis approach. The fourth section presents the survey results and discusses their significance. While the last section provides a summary of the research and proposes future direction.

II. BACKGROUND

Learning is an essential activity and is even more vital for youth, because through its institutions they prepare for their future roles in the development of their societies and acquisition of success in life [13], [14]. There are many definitions for learning, the Oxford Companion to Philosophy defines it as “the acquisition of a form of knowledge or ability through the use of experience”. Another one is that “learning is an activity with purpose of making change in behavior, attitude, habits, knowledge, skill, etc.” [15].

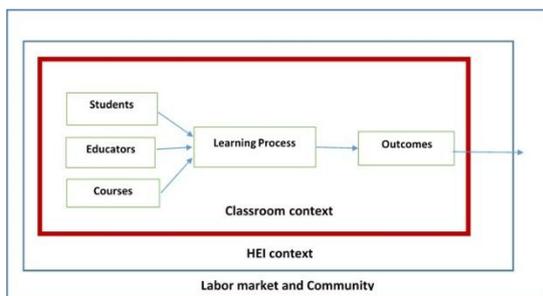


Fig. 1. Learning process

Learning is done through providing and improving the learning process. The learning process is comprised of the interaction between institution, educator, student, environment and courses. The outputs from the learning process are the graduate students and their quality [16], [17]. Fig. 1 gives a general view of the learning process and the

interaction between its elements. The practice of learning is done in a classroom context. This could be a physical classroom in face-to-face traditional education or virtual classroom in e-learning. The classroom setting affects the ongoing learning process. Classrooms are generally inside the HEI context, where all regulations, policies, environment and facilities provided by the institution affect the learning process. There is a strong bidirectional relation between the labor market and the HEI context, as labor market and community requirements affect the design of curriculum to produce graduates who in turn contribute to community and business development. The community is affected by the final output, because the development of community in all aspects such as, economic, political, social and cultural depends on the outputs of the learning process.

From the preceding information and discussion, we conclude that the learning process is complex, interconnected and involves many factors and stakeholders. Identifying these factors and how they affect the learning process is an important issue for any improvement. Similarly, stakeholders play a role in the success or failure of the process, with students being the most important one. For two reasons, first they are at the heart of the process being the main customers for HEIs. Second, their success is the target and outcome of the whole process as graduates. Therefore, any effort to improve the learning process must take into account the view point of students. This includes investigating their attitude, expectation and perception toward various specific activities and characteristic features of the process, along with socioeconomic factors. The next section presents and explains the factors affecting the learning process in more detail.

Numerous recent research articles have proposed utilizing ICT tools and techniques to assist in HEIs management and planning. For example, using ICT to support management process [18], to help with decision-making [19], staff development and curriculum design [20], and for general administration (payroll, administration of students’ data, etc.) [21]. In this study, data clustering technique is utilized to analyze the case study survey results. Clustering is an unsupervised learning data mining method that has become an essential component to various organizations due to its significance in decision-making support. Data mining is the process of analyzing data from different perspectives and summarizing it into important information so as to identify hidden patterns from a large data set [22].

Clustering is the process of partitioning a set of data into a set of meaningful groups, called clusters. Clustering algorithms can be used to find natural groupings when there are many cases and no obvious groupings. Clustering relevant data in several clusters makes it easy to analyze. In this study we explore and analyze the factors that affect the learning process

from students view. Thus, partitioning students in groups based on their characteristics and how they assess these factors, simplifies data analysis and the understanding the problem.

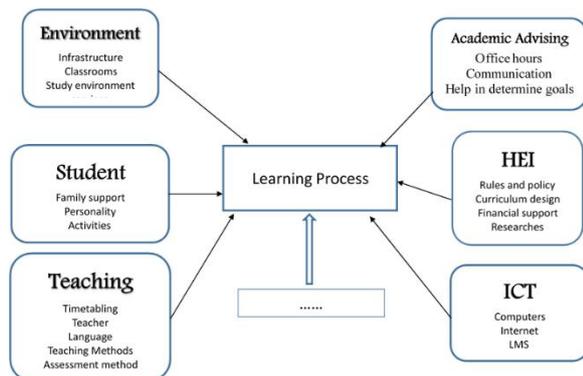
The widely used clustering algorithm, K-means, is the one selected for data analysis. It is considered a hard-clustering algorithm since each object is assigned to one cluster. The k-means algorithm is simple and easy to understand [23].

III. METHODOLOGY

This section describes the methodology used to realize the research objectives by answering the research questions. It is organized into two phases: in the first phase content analysis and analytical research procedures are used while performing an extensive review of literature to identify the factors that affect the learning process. In the second phase a questionnaire is designed to gauge the effect of the previously identified factors on the process.

A. Factors Affecting the Learning Process

In the first phase, we review the literature to explore, identify and analyze in detail the learning process, factors affecting it, and stakeholders involved. Consequently, and as outlined in the previous section, the process of learning is influenced by many factors related to student, family, class, colleagues, educators, courses, teaching methods, technology, HEI policy, regulations, aids and the general environment. These factors can be grouped into six main factor groups or dimensions, namely: environment, student, teaching, academic advising, HEI, and ICT.



HEI, and ICT.

Fig. 2. Factors affecting learning process

Fig. 2 presents these six dimensions with arrays of their comprising factors or characteristics. These arrays are dynamic and can expand or reduce in size over time.

1) **Environment:** The learning environment refers to the space allocated for classrooms, science labs, open spaces and offices. It also refers to diverse physical locations, contexts and culture in which students learn [24]. From this definition we can see that environment is about different physical aspects

that affect the learning process inside the classroom, e.g., light, sound, air condition, seats, etc., and outside the classroom. The physical classroom environment is one area that makes an obvious impact on students' success because most of their time is spent there. There is a clear relationship between the physical structure of classroom and the psychological factors as behavior and interaction in the classroom [25].

The HEI environment outside the classroom, such as roads, garden, parking, adjacent buildings, easy movement, etc., all these things affect the behavior of students and their achievement and their motivation towards study.

2) **Student:** The student plays an important role in the success of the learning process. There are many student characteristics that influence the process. First, is motivation or desire, and this the driving force behind student learning and success [26]. Second, is family environment and support. This is characteristic is reflected in students' relation to their parents, their communication with them, and their family income. Students who live in stable family environment and find good support, do well in their studies. Third, the relationship and communication with colleagues.

3) **Teaching:** This dimension contains five important factors, the first and foremost factor is the educator. The role of an educator at HEIs is more like a facilitator than teacher, as she/he leads students through the learning process. Educators play an extremely important role in guiding students to achieve their academic goal [25]. One of the basic elements that influence the learning process is educators having solid and up-to-date knowledge, and encouraging interaction with students in and out of the classroom. There are technical and personal requirements in the teaching factor, such as: appropriate verbal instructions, that can be interpreted as the method of teaching, feedback to students about their progress, good relationship with the student, and attitude towards the subject taught [26].

The second factors in the teaching dimension is teaching aids, and they are those materials that help educators explain better and help students understand. Teaching aids play an important role in the learning process, as they motivate students, clarify the information, and make the classroom alive and active. They are many types of teaching aids such as visual, audio, and audiovisual aids [27].

The third factor is courses, sequence of courses, contents, and curriculum design and if it relates to the labor market. All of these aspects influence the learning process. Courses content should meet students' need and their objective must be clear [17]. Related to contents is how the information is displayed or presented to students, the educator must take into account the different learning styles in the classroom [28]. Learning styles refers to the preferred way an individual processes information and also describes a person's typical mode of thinking,

remembering or problem solving. The basic learning styles are visual, auditory and Kinesthetic [29].

Courses assessment methods enable educators to ensure that students learn what they need to meet courses learning objectives. They include strategies, techniques, tools and instruments for collecting information to determine the extent to which students demonstrate the desired learning outcomes. Using multiple assessment methods leads to a complete view about students' achievement.

The fourth factor in this dimension is teaching method, and this is the method of subject delivery to students. Teaching methods must correspond to students' characteristics. There are different kinds of teaching methods, including lecture, discussion, question and answer and group work. Choosing the appropriate method leads to increased learning achievement [30]. The last factor in the teaching dimension is the lectures timetable. Timetable setting is an important issue, for example, if the timetable is compressed and does not contain any gaps between lectures, it negatively affects students' comprehension. Students need time between lectures to perform other activities such as eating, drinking, praying, etc. They also need to relax their mind so receiving new information could be easy.

4) **Academic Advice:** Advising is a process in which advisor and advisee enter a dynamic relationship respectful of the student's concerns. Ideally, the advisor serves as educator and guide in an interactive partnership aimed at enhancing the student's self-awareness and fulfillment [31]. Advising process can help students to identify personal strengths and interests related to their educational and career goals [32]. Academic advising is important because it is a central key to any student's success in college. Advisers monitor students' academic progress, give students the ability to navigate the HEI policies and procedures better, and assist students in their problems. Continuous interactions between students and their academic advisor is important and helps in increasing student retention [33], and this plays a vital role in improving the learning process.

5) **HEI:** The HEI itself plays a key role in the learning process by designing curricula related to the labor market and providing the necessary environment for students and educators. HEI must also establish clear and understandable policies and regulations for students, offer incentives to superior students, while providing financial assistance to poor students. Moreover, HEI develop research projects and reflect their results on the whole process. All of these characteristic factors directly affect the quality and efficiency of the learning process.

6) **ICT:** It is obvious that ICT utilization and its necessary support have strong influence on all stakeholders of the learning process. They do so in a number of ways, such as, facilitating educators' access to information, the preparation of educational materials and the presentation of information to

students. ICT provides the possibility of sharing information between educators and students, and students among themselves. It also enables opportunities for discussion and exchange of ideas through the use of academic sites, social media and collaboration work techniques [34]. Furthermore, the availability of adequate numbers of computers, high speed internet, Wi-Fi, secure data processing and support are extremely important for students and facilitates their learning.

B. Survey Design

In the second phase of the research, a survey was designed to capture students' feedback on the identified factors influencing the learning process. The questionnaire consists of two sections, the first is about personal data to illustrate the characteristics of the sample of the study, including college, department, academic year and gender. The second section is divided into six sub-section corresponding to the dimensions outlined earlier. These sections consist of 71 questions with each dimension covering its related factors.

A five-point Likert scale was used to measure student responses to the questionnaire sections as follow: 1 - "strongly disagree", 2 - "disagree", 3- "neutral", 4 - "agree", 5 - "strongly agree"

The WEKA data mining tool was used for analyzing the survey results. WEKA stands for Waikato Environment for Knowledge Analysis, and it is a data mining or machine learning tool [35]. It is an open source tool that supports different standard data mining tasks such as data preprocessing, classification, clustering, regression, visualization and attribute selection. WEKA is easy to use and has many built-in features that require no programming [36].

IV. RESULTS AND DISCUSSION

The participants in this study are students from the CSIT College at SUST. CSIT has four departments, namely, Computer Sciences (CS), Computer and Information Systems (CIS), Computer Systems and Networks (CSN) and Software Engineering (SE).

TABLE I. GENERAL CHARACTERISTICS

Department	Students	Male	Female
CS	83	36	47
CIS	72	35	37
CSN	79	28	51
SE	113	54	59
Total	347	153	194

As Table I shows, the total number of students who responded to the questionnaire is 347, of those 153 are male (44%) and 194 are female (56%).

The K-means clustering algorithm utilized for data analysis allows users to select the number of clusters. In this study, after exhaustive testing, we decided to

use three clusters (k=3) since it gave clear and understandable results. This implies that all analysis results will be divided in three groups based on respondents’ feedback. These groups will be called Cluster0, Cluster1 and Cluster2.

1) **Environment:**

TABLE II. ENVIRONMENT DIMENSION

Factor	Cluster0	Cluster1	Cluster2
1 HEI infrastructure	2.3	3.3	2.8
2 Transportation	1.6	2.5	1.8
3 Classroom environment	2.2	4.0	3.1
4 Study environment	2.0	3.5	2.9
5 HEI services	1.8	2.9	2.4

Table II show the results of the five Environment factors and the Mean for the three clusters, i.e., cluster0, cluster1 and cluster2. Each cluster represents a group of students and the Mean is the output from the K-means algorithm. The Mean here represents the weighted average. Since we are using Likert quintet, the range is 4, and the number of options equals 5, then the weighted average becomes 0.8. Therefore, each option Mean falls in the following range: 1-1.79 “strongly disagree”, 1.80-2.59 “disagree”, 2.60-3.39 “neutral”, 3.40-4.19 “agree”, and 4.20-5 “strongly agree”. It is clear from Table II that “Transportation” is a problem that faces the majority of students. All students have to commute to and from the SUST campus and the lack of transportation affects their morning lectures attendance. The results of “HEI services” too show that most students are not satisfied with services such as healthcare and cafeteria services.

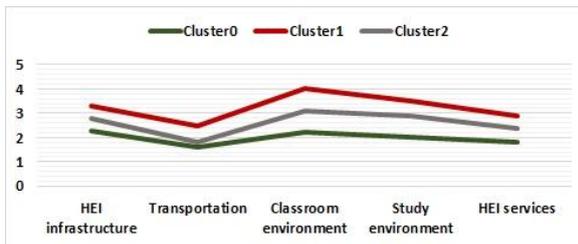


Fig. 3. Environment Dimension

Fig. 3 is a line graph of the Environment dimension results, where the y-axis represents the Mean. From the figure we can clearly see that students grouped in Cluster0 are not satisfied with the environment factor in general. Cluster1 students are mostly neutral but they are satisfied with the classroom environment. Cluster2 students are dissatisfied with both transportation and HEI services while they are neutral with other factors.

2) **Student:**

TABLE III. STUDENT DIMENSION

Factor	Cluster0	Cluster1	Cluster2
Family support	3.7	4.4	4.1
Personality	2.6	3.8	3.4
Extracurricular	1.7	3.4	1.9

Table III presents the results of the Student dimension. “Family support” explores the student’s relation with his/her parents, the ability to communicate with them, and also if the student can pay tuition fees. From Table III results, the general pattern of answers is “agree”. This means that most students have good financial and moral support from their families.



Fig. 4. Student Dimension

Fig. 4 is a bar-chart representation of the Student dimension and the y-axis represent the Mean. The second factor, i.e. personality, exposes the students’ desire to study, communicate with colleagues, and communicate with people responsible of his/her affairs. From the results in Fig. 4, we can see that some of students have problems with this factor. The third factor deals with extracurricular activities such as political, sports, cultural, etc. It addresses the availability of time and infrastructure to practice such activities on the SUST campus. The results in the table and graph clearly demonstrate that SUST needs to put more emphasis on supporting these activities as they positively effect students and the learning.

3) **Factor 3: Teaching**

TABLE IV. III TEACHING DIMENSION

Factor	Cluster0	Cluster1	Cluster2
Lectures Timetable	1.4	2.8	1.9
Language barrier	2.3	3.4	2.8
Teaching method	2.3	3.4	2.8
Teaching support	2.8	4.1	3.6
Communication	2	3.5	2.8
Collaborative work	2	3.8	3.2

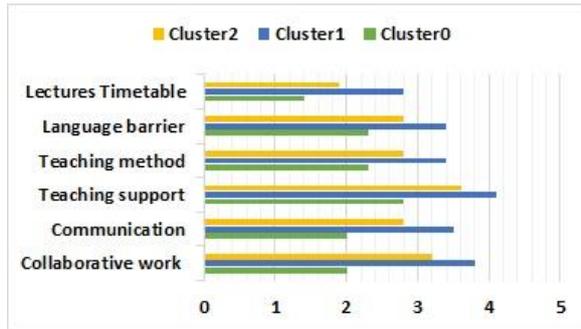


Fig. 5 Teaching Dimension

Result of the analysis of the Teaching dimension and its factors is presented in Table IV and Fig. 5. Generally, most responding students ranked all factors low except the students in Cluster1, they ranked “Teaching support” and “Collaborative work” high. These results reflect the strong dissatisfaction of students with the teaching dimension, and have negative impact on the learning process. Consequently, there is an urgent need for improvements as the teaching factors play vital role in learning process and have direct relation with students’ satisfaction.

4) **Academic Advice:**

TABLE V. ACADEMIC ADVICE

Factor	Cluster0	Cluster1	Cluster2
Office hours	1.2	3.7	2.2
Communication	3.5	3.4	1.7
Help to determine goals	3.2	3.6	1.5

With regard to this dimension, students were asked about the office hours for meeting their advisor, the communication with the advisor, and if they get adequate assistance from her/him to achieve their goals. From the result presented in Table V, there are varying views between dissatisfied and satisfied, and this is due to the evaluation of different advisors. This indicates that there is a difference in performance between academic supervisors.

5) **HEI:**

TABLE IV. HEI DIMENSION

Factor	Cluster0	Cluster1	Cluster2
1 Curriculum design	2.9	2.4	2.0
2 Additional education opportunities	3.9	1.9	1.9
3 Financial support	3.4	3.0	1.9
4 Students’ affairs	3.7	3.3	1.9

HEI dimension has four factors as shown in Table VI. The “Curriculum design” factor addresses the process of course design and the sequencing of courses. From the results in Table VI, the majority of

students are not satisfied with this factor since the Mean value is less than 3 in all clusters, meaning that it negatively affects the learning process. The second factor in the table explores if the HEI provides additional education opportunities, such as professional or summer training, internship support, international research projects, etc. This factor too has a negative effect on learning process because students in Cluster1 and Cluster2 are not satisfied. The third factor in this dimension, deals with the financial support for students. Here responses vary, as some students see that SUST provides enough support while others disagree. The last factor addresses students’ affairs, i.e., do students know where to go if they have a problem or issue, and to whom do they talk. Again, in this factor there is no agreement. From the discussed results we conclude that there are some factors in the university HEI dimension that need improvement.

6) **ICT:**

TABLE V. ICT DIMENSION

Factor	Cluster0	Cluster1	Cluster2
Technical support	4.0	4	2.1
Network and internet Availability	3.6	2.6	2.2
Availability of LMS	3.6	1.8	2.1

From Table VII, most students are satisfied with the first factor, i.e., availability and accessibility of computers and technical support. At the same time, most are not satisfied with the second factor, i.e., internet, network, and Wi-Fi availability, the Mean value is less than 4 in all clusters. This implies that there is a need to provide better internet connectivity with high speed and Wi-Fi connection in order to improve the learning process. The last factor is about the availability of a Learning Management System (LMS), and the majority of students don’t know about LMS and have not used it. ICT is important factor, and there is relation between ICT and other factors. Supporting and encourage the using of ICT will lead to improve the learning process.

V. CONCLUSION

This paper has investigated the factors that affect the learning process at HEIs. It has identified essential factors and empirically examined the core stakeholders’ (students) feedback. A survey instrument was used to collect data from the target group, i.e., CSIT students at SUST. Analysis of the survey results has shown that there are various factors that adversely affect the learning process at SUST. For example, transportation, HEI services, including cafeteria and healthcare services, lectures timetable, academic advice, curriculum sequences and ICT support. These factors require further in-depth study, focus and analysis by SUST administrators to explore

ways to improve performance and thus enhance the learning process. Furthermore, the research has shown that ICT support is a vital factor, not only because it impacts all stakeholders, but also for its influence on other factors as well.

This study has laid the foundation for improving the learning process, and achieved the outlined research objective, while demonstrating that the use of data analysis tools and techniques is a key component in supporting HEIs administrators and planners in their decision-making. It has also provided the base for further research and extending to other data analysis techniques, case studies, and other related contexts.

REFERENCES

- [1] The World Bank, "Higher Education in Developing Countries: Peril and Promise," Washington, DC, 2000, p. 138.
- [2] F. Teal, "Higher Education and Economic Development in Africa: A Review of Channels and Interactions," *Journal of African Economies* 20, no. Suppl. 3, 2011, 50-79.
- [3] JICA (2004). "Approaches for Systematic Planning of Development Projects/higher education."
- [4] Danil, SIR John. "Higher Education: Past, Present, and Future--A View from UNESCO." *Higher Education in Europe* 28, no. 1 (2003): 21-26.
- [5] Crosling, Glenda, Margaret Heagney, and Liz Thomas. "Improving student retention in higher education: Improving teaching and learning." *Australian Universities' Review, The* 51, no. 2 (2009): 9.
- [6] Crosling, Glenda, Margaret Heagney, and Liz Thomas. "Improving student retention in higher education: Improving teaching and learning." *Australian Universities' Review, The* 51, no. 2 (2009): 9.
- [7] Zhang, Ying, Samia Oussena, Tony Clark, and Kim Hyensook. "Using data mining to improve student retention in HE: a case study." (2010).
- [8] Agaoglu, Mustafa. "Predicting instructor performance using data mining techniques in higher education." *IEEE Access* 4 (2016): 2379-2387.
- [9] Raju, Dheeraj, and Randall Schumacker. "Exploring student characteristics of retention that lead to graduation in higher education using data mining models." *Journal of College Student Retention: Research, Theory & Practice* 16, no. 4 (2015): 563-591.
- [10] Asif, Raheela, Agathe Merceron, Syed Abbas Ali, and Najmi Ghani Haider. "Analyzing undergraduate students' performance using educational data mining." *Computers & Education* 113 (2017): 177-194.
- [11] Berkhin, Pavel. "A survey of clustering data mining techniques." In *Grouping multidimensional data*, pp. 25-71. Springer, Berlin, Heidelberg, 2006.
- [12] Gulati, Hina, and P. K. Singh. "Clustering techniques in data mining: A comparison." In *2015 2nd international conference on computing for sustainable global development (INDIACom)*, pp. 410-415. IEEE, 2015.
- [13] Siming, Luo. "Factors Leading to Students' Satisfaction in the Higher Learning Institutions." *Journal of Education and Practice* 6, no. 31 (2015):114-118..
- [14] Khurshid, Fauzia. "Factors affecting higher education students' success." *Asia Pacific Journal of Education, Arts and Sciences* 1, no. 5 (2014): 40-47.
- [15] Lachman, Sheldon J. "Learning is a process: Toward an improved definition of learning." *The Journal of psychology* 131, no. 5 (1997): 477-480.
- [16] Betoret, Fernando Doménech, and Adela Descals Tomás. "Evaluation of the university teaching/learning process for the improvement of quality in higher education." *Assessment & evaluation in higher education* 28, no. 2 (2003): 165-178..
- [17] Pavione, Caroline Stéffani Santos Nério, Bruna Camargos Avelino, and José Roberto de Souza Francisco. "Factors that Influence the Teaching-Learning Process from the Perspective of Accountancy Students: Analysis at a Higher Education Institution in Minas Gerais." *Revista de Educação e Pesquisa em Contabilidade* 10, no. 2 (2016).
- [18] Ujunju, Michael Okumu, G. Wanyembi, and Franklin Wabwoba. "Evaluating the role of information and communication technology (ICT) support towards processes of management in institutions of higher learning." (2012).
- [19] Laudon, Kenneth C. *Management information systems: Managing the digital firm*. Pearson Education India, 2007.
- [20] Mostert, Markus, and Lynn Quinn. "Using ICTs in teaching and learning: Reflections on professional development of academic staff." *International Journal of Education and Development using ICT* 5, no. 5 (2009): 72-84.
- [21] Krishnaveni, R., and J. Meenakumari. "Usage of ICT for Information Administration in Higher education Institutions--A study." *International Journal of environmental science and development* 1, no. 3 (2010): 282-286.
- [22] Borkar, Suchita, and K. Rajeswari. "Predicting students academic performance using education data mining." *International Journal of Computer Science and Mobile Computing* 2, no. 7 (2013): 273-279.
- [23] Solanki, Harshvardhan. "Comparative study of data mining tools and analysis with unified data mining theory." *International Journal of Computer Applications* 75, no. 16 (2013): 23-28.
- [24] Amirul, Nurul Jannah, C. N. Che Ahmad, Asmayati Yahya, M. F. N. L. Abdullah, Mazlini Adnan, and N. Mohamed Noh. "The physical classroom learning environment." In *Proceedings of the International Higher Education Teaching and Learning Conference*, vol. 2, no. 1, pp. 1-9. 2013.
- [25] Puteh, Marzita, Che Nidzam Che Ahmad, N. Mohamed Noh, Mazlini Adnan, and Mohd Hairiy Ibrahim. "The classroom physical environment and its relation to teaching and learning comfort level." *International Journal of Social Science and Humanity* 5, no. 3 (2015): 237-240.
- [26] Aslam, Hassan Danial, A. Younis, A. A. Sheik, M. Z. A. Maher, and Z. A. Abbasi. "Analyzing factors affecting students' satisfaction regarding semester system in universities of Pakistan." *Journal of American Science* 8, no. 10 (2012): 163-170.
- [27] Nikky, S. "Characteristics of Good Teaching Aids." Retrieved December 4 (2010): 2012.
- [28] Abante, Mark Enrick R., Benjie C. Almendral, Jay-ren E. Manansala, and Jovielyn Mañibo. "Learning styles and factors affecting the learning of general engineering students." *International Journal of Academic Research in Progressive Education and Development* 3, no. 1 (2014): 16-27.
- [29] Abante, Mark Enrick R., Benjie C. Almendral, Jay-ren E. Manansala, and Jovielyn Mañibo. "Learning styles and factors affecting the learning of general engineering students." *International Journal of Academic Research in Progressive Education and Development* 3, no. 1 (2014): 16-27.
- [30] Cook, Sandra. "A chronology of academic advising in America." *The Mentor: An Academic Advising Journal* 1, no. 2 (1999).
- [31] Young-Jones, Adena D., Tracie D. Burt, Stephanie Dixon, and Melissa J. Hawthorne. "Academic advising: does it really impact student success?." *Quality Assurance in Education* (2013).
- [32] Lau, Linda K. "Institutional factors affecting student retention." *Education-Indianapolis then Chula Vista-* 124, no. 1 (2003): 126-136.

- [33] Munawaroh, N. "*The influence of teaching methods and learning environment to the student's learning achievement of craft and entrepreneurship subjects at vocational high school.*" *International Journal of Environmental & Science Education* 12, no. 4 (2017): 665-678.
- [34] Kumar, DTT Vijaya, J. Senthil, and Ramesh Palanisami. "*Optimizing Resources in Teaching and Learning using Cloud Technology.*"
- [35] Han, Jiawei, Jian Pei, and Micheline Kamber. *Data mining: concepts and techniques*. Elsevier, 2011.
- [36] Bouckaert, Remco R., Eibe Frank, Mark A. Hall, Geoffrey Holmes, Bernhard Pfahringer, Peter Reutemann, and Ian H. Witten. "*WEKA: Experiences with a Java Open-Source Project.*" *Journal of Machine Learning Research* 11, no. Sep (2010): 2533-2541.