ICT Utilization and Improving Students Performance in Higher Education

Sumati Pathak, Rohit Raja, Vaibhav Sharma, Srinivas Ambala

Abstract*: Nowadays, higher education providing institutions depend upon Information and Communication Technologies (ICT) for all purposes like teaching, administration, learning and other research related works. ICT is found to be a major resource for bringing competitive growth for an organization. In general, the use of ICT in higher education institution plays a vital role in providing modern learning approaches. Further, the utilization of data mining in ICT can predict the performance of students and offer a way to improve it. This paper identifies the usage of ICTs among higher graduates and the impact of parameters such as gender, area of interest as well as name of the university. In addition, data mining based ranking algorithm is introduced in order to analyze the performance of students. The evaluation results show that the use of ICT in higher education provides technological improvements and these enhancements are associated with factors such as gender, area of interest as well as university. Moreover, the ranking algorithm can easily evaluate the ICT based performance of higher education institutions.

Index Terms*: ICT, data mining, ranking algorithm, higher education institutions.

I. INTRODUCTION

Information and communication technologies include internet, computer and software, peripheral devices, mobile technologies that permit access to data, interaction within entities like organizations, individuals and countries and so on. Universities and colleges are implementing ICT to offer high quality education and to become innovative and attractive. Thus, the growth of usage of ICT in higher education is developing day-by-day. As an initial stage, the use of digital devices in institutions is paving a platform to bring forth the advantages of ICT related to teaching quality and learning outcomes. The continuous implementation of modern technologies is ongoing, and now the university management is searching a way to motivate the teachers to utilize ICT in their way of teaching. The major challenge in implementing ICT in education is that it empowers new "possibilities" to students and teachers, i.e., it will not provide ready to use source materials [1]. Modern ICT technologies have provided all resources for i-society and e-society [2]. The phenomenon of implementing ICT in institutions is started two decades ago. It clearly demonstrates the scope and current position of ICT in higher education. The purpose of ICT in education has been researched by scientists all over the world. Due to the recent advancements in ICT, modern technology has influence over various area of knowledge. In the field of education, ICT is found to be boon to both the teachers as well as students. The base technology of ICT is electronics that support the growth of telecommunication, audiovisual and computers [3]. Initiation of internet services has not stopped generating new opportunities, platforms and projects associated with learning in institutions like schools and colleges. Implementing technology in education is compulsory as it is necessary for improving the skills of learning. In this modern world, ICT plays a major role to provide information about latest technological developments. Thus, ICT related education is also very essential since it is the primary source for the social and economic development of a country. Education not only expands the industrial skill of a human but also improve their earning skill. Education brings out well-being manner, ability to understand new ideas, enhances the social communication, provide benefits on improved health and so on. Various products of ICT that are used in education field are audio conferencing, email, radio broadcasting, teleconferencing, television, cassettes and ROM devices. Data mining concept is used along with ICT in variety of applications like advertising, engineering, health, marketing and information systems [4]. Data mining is defined as the process of knowledge discovery through pattern extraction among large amount of datasets. Education Data Mining (EDM) approach in data mining has improved the growth of education and data mining applications since the past 10 years. Data mining outcomes can be used to improve the process of teaching and learning, and it can also be used to take a decision for redesigning the learning infrastructure [5]. In general, data mining techniques are most probably used in e-learning or web based education for the purpose of providing: (i) resources, activities, tasks and learning paths to improve learning experience and performance; (ii) feedback to designers and teachers regarding the structure and difficulties of a course so that it can alert the students to revise the learning environment [6]. (iii) Guess the performance of learners [7] and (iv) notify the efficiency of instructional programs to administrators so that proper planning and allocation of resources can be achieved. In this paper, the impact of gender on the usage level of ICT in higher education is examined. It is known fact that after the introduction of computers, ICT based activities are seen as male dominated. Numerous differences among males and females were observed through technical ICT related applications. Since technology has become a part of workplace and day-to-day activities, researchers argue to overcome the male domination.

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Thus, it is necessary to redesign the existing potential influence of gender in ICT usage level in higher education institutions. This paper analyzes the gender-related characteristics in terms of location and the name of the university or institution. This analysis will improve the accessibility of e-learning and latest technologies among all the individuals irrespective of the gender. Further, a ranking algorithm is introduced that identifies the low performance students and make them use ICT to enhance their performance in e-learning. Thus the technological development will be a boon for all the individuals opting for higher education.

II. RELATED WORK

Number of research works has been reported regarding the gender differences in the usage of information and communication technologies. Heemskerk et al. [8] and Vekiri [9] focused the usage of ICT by youngsters in the society. Their survey resulted that males have better skills in ICT compared to the females. The usage level of ICT in leisure time is found to be increasing in case of males and their attitude towards ICT usage is getting improved on every day. This is because; they use ICT for playing games, recreation purpose, learning hardware related issues and for learning other individual challenges. Other activities include forming group networks with ICTs among students, neighbors and other individuals who are interested in using ICT applications. But, in case of females, the leisure time usage of ICT-ratio is found to be decreased and their attitude to ICT usage level is decaying day-by-day. ICT oriented activities among youngsters are seen as a kind of expertise, and it is sometimes appreciated by adults due to the advancement of technology in their surrounding environment. Several studies have revealed the utilization and characteristics of ICT on the basis of location, since in many cases; location limits the applications of ICT. The impact of introduction of ICT for economic growth and human development has been analyzed by the authors in [10], [11] and [12]. Peeraer and Van Petegem [13] explained that province provides a warning on the additional impact of appropriate parameters at the teacher education level on ICT usage. Fournier–Viger et al. [14] presented a rule growth approach to predict the performance of students in e-learning. Compared to normal sequential algorithms, the prediction accuracy of rule-growth algorithms is improved. But it performs costly database operations which in turn decreases its performance in large datasets. Faghihi et al. [15] suggested a technique to overcome the restriction on tutoring agent and they analyzed the learning capabilities of humans. Pham et al. [16] proposed an approach for evaluating the sequential performance in case of sequential datasets. Romero et al. [17] explained about Educational Data Mining (EDM), which is used to inspect the database in all higher education practices. Marquez Barja et al. [18] introduced a tool called as FORGE to know about all the latest technologies discovered in ICT. Nikolopoulos [19] realized a cloud-based approach using associated rule data mining. Bekteshi [20] explained that ICT is an efficient tool that identifies disabilities in academics of higher graduates. Soderstrom and Ytterhus [21] studied the effects of ICT-oriented technologies. Bravo et al. [22] examined how to enhance the learning process in higher education using ICTs. Jabbar [23] offered a technique to improve and increase the application of ICT in medical field. Singto et al. [24] indicated the development of ICT in career analysis. Several applications of smart learning based on data mining was put forward by Raja et al. [25, 27], Jones [26],Agrawal et al. [28],Thangamani and Chandar [29],Tandan et al. [30] andSinha et al. [31],

From the above analysis, it is clear that gender plays a major role in ICT based learning processes. This feature has not been analyzed among the graduates in higher education institution. Moreover, the existing works have ignored the analysis of location and area of interest while examining the utilization of ICTs. So, in order to determine the successfulness of ICT, this paper focuses on analyzing the application of ICT through datasets of higher graduates. Even though ICT identifies the performance of students, data mining based ranking algorithm is introduced to enhance the performance of students. The ranking algorithm is utilized to overcome the difficulties of the challenging graduates to increase their performance in e-learning.

III. METHODOLOGY

ICT is comprised of many communication oriented tools such as cellular phones, computer, radio, television, software and hardware networks, satellite devices and other activities associated with it such as distance education and videoconferencing. As these technologies are used in higher educational institutions to enhance the learning performance of students, ICT is said to be an advanced field under education technology. In higher education, ICTs are used as a learning resource for delivering as well as sharing content, to interact among learners, teachers and students, preparation and presentation of academic research, lectures and for other purposes like management support, student enrolment activities and so on.

A. Dataset Formation

The first step of analyzing the influence factors of ICT in higher educational institution is dataset formation. ICT based test activities of 1000 graduates were taken from two universities with 500 datasets from a small university and remaining 500 datasets from comprehensive one. From the datasets, sample units were selected by applying random sampling on the large datasets. ICT activities of graduates were analyzed for two academics in order to limit the potential biases from other academics. The sample datasets shows the graduate universe of higher educationalist in the two universities. This analysis includes almost all areas of interest in the engineering field like electronics, computer science, mechatronics, robotics and artificial intelligence. The sample datasets upholds a ratio of men/women in the graduate database as shown in Table 1.

Table 1. Higher educational graduate dataset

Gender	Male	34.27
	Female	65.73
Field of interest	Electronics	28.22
	Computer Science	25.34
	Mechatronics	17.34
	Robotics	20.26
	Artificial Intelligence	08.84
University	ABC	45.00
	XYZ	55.00

B. ICT measuring tools

The impact of ICT in higher education is tested by using a measuring tool. Several questionnaires are prepared and it is used as a measuring tool to observe the involvement of students in ICT oriented test activities. In the proposed method, usage of ICT is tested by using a 10 point scale with 7 items. The 10 points of the scale is ranged from 10 means agree to 1 means disagree. ICT tools are mainly categorized under three categories like: interaction, author and management tools that support research, teaching, learning and other education services. According to this scale, the final questionnaire is prepared and further analysis is preceded. Table 2 presents the 7 items that denotes the strength of ICT in higher educational institutions. The first three items helps the institution management, interaction between individual's, teachers and students. The remaining 4 items supports only the teachers and the research personnel.

Table 2. ICT measuring tool

ICT1	Searching the university sites to collect information
ICT2	University central (to know about marks, fee details, events, etc.,)
ICT3	Mail address of university
ICT4	Study materials
ICT5	Digital sources of the university
ICT6	Smart class usage
ICT7	Internet usage

C. *Ranking Algorithm*

Figure 1 represents the framework that is followed to know and improve the performance of students associated with ICT usage. Data mining based ranking algorithm is used for this purpose. This ranking algorithm compares the datasets of higher educational students. The datasets consists of two groups: one represents the students who follow the ICT activities and the other group represents the students who do not follow information and communication technologies. The ranking algorithm follows the same procedure as given in Table 2 to rank the performance of students. But the ranking is provided on a 5 point scale to rank the items whether it is worst or best to improve the performance of students. By using sampling approach, necessary variables are extracted from the graduate datasets. Then ranking algorithm is applied over the sample datasets. It classifies the necessity of ICT materials for learning purpose of students in a 5-point scale. The performance of students for each material is analyzed and this is used for further enhancement of ICT based education.

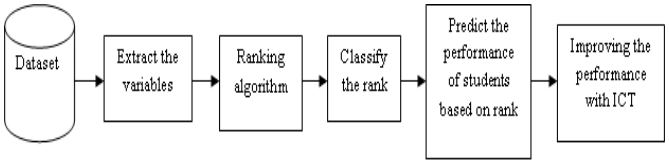

Figure 1. Improving the performance of students with ICT

IV. RESULTS AND DISCUSSIONS

ICT usage is determined by deploying the 10 point scale in four formats like not used, periodically used, used often and used regularly. For the graduate datasets, the analysis is done and the ICT usage level is obtained as listed in Table 3. It shows that the percentage of utilization of ICT in higher education is higher on regular basis. Thus, ICT is regularly used by higher graduates for various purposes like learning, research and so on.

Table 3. ICTs usage analysis (in %)

ICTs	Not used	Periodically	Often	Regularly
ICT1	4.7	23.56	31.89	39.85
ICT2	5.8	17.98	29.60	46.62
ICT3	4.8	21.45	35.69	38.06
ICT4	5.3	12.45	35.70	46.55
ICT5	7.8	5.76	49.65	36.79
ICT6	4.5	7.8	29.89	57.81
ICT7	2.9	13.57	28.94	54.49

The outcomes reveal the influence of analyzed parameters against the application of ICT in education. It confirms that the usage of technology in education mostly depends upon gender, area of interest and the type of university. However, gender plays a major role to identify the utilization of ICT. It almost provides the utilization of ICT in all forms, except smart class usage and usage by university central authorities. Additionally, it should be noted that the area of interest only affects the usage of two ICT variables like: study materials and internet usage. Moreover, the impact of university is found in variables such as: study materials, digital sources and smart classrooms. Performance improvement Analysis
From the ranking algorithm, the utility of ICT materials among graduates are analyzed and the usage is further motivated based on their performances. It is identified that disability students have improved their learning activities through information and communication technologies. The usage of ICT among male and female with and without using ICTs are shown in Figure 2.

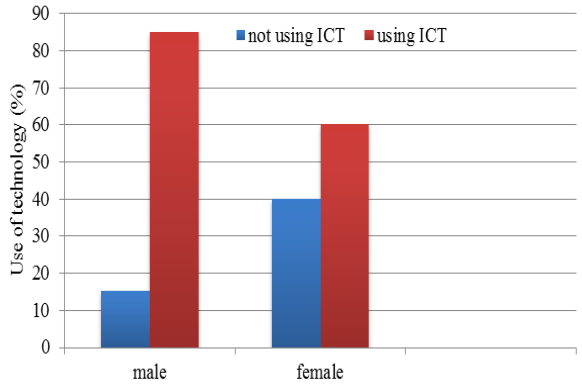

Figure 2. ICT interestingness evaluation among higher graduates

V. CONCLUSION

The application of ICT in higher education can improve the efficiency as well as importance of education and learning. This is proved by higher graduates who use ICT equipments in their learning areas to gain adequate technical skills. It improves the commitment of individuals towards higher education and learning by providing vast amount of e-learning materials. The impact of certain variables against the usage of ICT is determined in order to make ICT popular among higher graduates. Thus, this paper is proposed to achieve this need by analyzing the datasets of higher graduates in terms of gender, area of interest and type of university. In addition, data mining based ranking algorithm is used to find the performance of students with ICT. This provides a way to enhance the student's performance with the usage of ICT tools. The experimental analysis shows that the parameters have greater influence on the utilization of information and communication technologies.

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