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Lifelong Learning in higher education using Learning Analytics

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Abstract

The conventional education system lacks the focus to create employable graduates. The existing industries in the Information Technology sector widely recruit based on a very specific set of skills and academic performances. To create better career opportunities, the colleges and universities should ensure that the graduates are qualified to accomplish the basic skills required by any organizations. This demands systematic approaches to be adopted with an innovative teaching style during the academic curriculum-based training in engineering colleges. The international accreditation organization ABET is a worldwide recognized educational board that provides streamlined guidelines for competency skills and to deliver a quality education for students. In this research work, an extensive study has been performed on the needs of the industry and it has been compared to the quality of the course being offered to the students. The curriculum is designed based on the industry experts' feedback. To achieve the Student Outcome Criteria as per ABET accreditation, the practices of structured approach is adopted along with the vision of lifelong learning in this research work. The teaching-learning process of first year under-graduate programming course and its evaluation techniques is considered in this research work. The competency skills like problem solving skills, critical thinking, and creative thinking are analysed using learning analytics strategies for first year Python programming course. The performances of the students are broadly categorized based on the metrics like logical, conceptual, analytical and conceptual thinking, while simultaneously focusing on their time management skills and commitment to learn. Artificial Neural Network (ANN), Naive Bayesian algorithm and logistic regression models are used to identify and measure the competency skills of the learners achieved in this course and validating these metrics with the student learning outcome. Implementing Artificial Intelligence concepts will provide results that can aid in creating the most suitable teaching-learning environment resulting in the best outcome for disruptive engineering education. Learning Analytics will provide an understanding and optimization of learning and its environments thereby ensuring sustainable development. This analysis presents an opportunity to identify the gap between the academic curriculum and the industry's expectations in terms of competency skills to be acquired by the learners. Additionally, it helps to improve the teaching-learning process according to the dynamic changes from the industries and builds the foundation for students to be lifelong learners.

Keywords: Artificial Intelligence, Deep Learning, Learning Analytics, Competency Skills

1. Introduction

Using technology for education offers the opportunity to develop open and self-directed courses supports the age-old system of existing teaching-learning techniques. Now, instead of a deluge of information from teachers into the brains of the students followed by a rigorous examination in the end, the practice of "learning by doing" is gaining more popularity among the

teachers and students. Such courses emphasize on the development of various skills to acquire lifelong learning traits for the students throughout their lifespan. The use of ICT tools and innovative teaching methods can aid in the development of the critical and analytical abilities to work as a self-directed learner along with good communication skills and team work. The competency skills are part of lifelong learning skills and it is the responsibility of the university and colleges to train the learners for acquiring such skills. For each course, the learning outcomes are defined during the curriculum design and pedagogical methods are focussed on achieving such student outcomes. The ABET [4] board has defined various learning outcome and lifelong learning skills are given priority for the undergraduate students which states that "recognition of the need and an ability to engage in lifelong learning". The development of competency skills plays essential role in moulding the engineers for future jobs and excel in the professional life. With this significant focus, the undergraduate engineering students must be educated for competency skills from the first year of graduation. With this objective, this research work is emphasized on establishing lifelong learning skills by acquiring higher order competency skills.

2.   Related Work

In competency-based approaches we can find the bridge between the traditional methodology, which heavily depends on general credit hour measures of student achievement, and the learning revolution. [2]. Owed to the change in the way students view their expanded learning options—especially issues connected to convenience—should force all institutions to retrace and rework their syllabi and the menu of their current offerings. There is now a demand for certification of competencies and these are not met by traditional higher education institutions and hence has become challenging since there is no reporting mechanism for them. The evidence is typically expressed in terms of retention rates, graduation rates, and placement rates—outcomes that typically are not direct measures of what students know or can accomplish. In contrast, competencies and the learning that they tend to measure operate at a much more granular level and require precise description and measurement of learning. An outgrowth of this study [3] was the recent conclusions drawn by a quality assurance agency that aims to work with institutions to establish small, expert teams to provide benchmark information on standards, in particular threshold standards, operating within the framework of qualifications. The establishment of the Learning Skills Council, a government partnership that is responsible for planning, funding, and improving the quality of post-sixteen, or postsecondary, learning up to university has been the endgame of these national discussions. Student learning across the United States was not accurately quantifiable by the State-by-State Report Card for Higher Education. Other factors limit state-by-state comparisons of student learning, including disparities in student drive to score well and a general lack of willpower,politically as well as resources to adequately fund state wide testing.

3.Proposed Work

The objective of this project is to evaluate the lifelong learning competences of the students. The Usual valuation techniques and methods are surveys, questionnaires and some online tools. But, for the scope of this project we are assessing the competences by analyzing student scores from different categories of tests like MCQ's, Challenging Tasks, and Practice tests. The classroom teaching styles are designed to ensure that all students succeed in college and prepared for career readiness, consistent with the Common Core of world class knowledge and skills. It also took advantage of the extraordinary technological advances in online learning for personalization, allowing students to learn at their own pace, any time, anywhere and any device.

or the proper analysis we have conducted survey from IT employees for the important competences a computer science student actually need. The responses are collected and analysed further to get the top most competences suggested by them. Taking those important competences as base, we defined the attributes for assessing the competences. Student's competences are tested using those defined methods. And their levels of competences are categorized from excellent to poor. So we have adopted the approach of quantitative analysis on a group of students to check their competence levels. Their performance in different categories of tests is tracked and finally the results are analyzed and displayed. And we can get the level of competencies achieved by individual student. Finally, we represent the level of competence of individual student and overall percentage of skills that are achieved by first year graduates.

Table 1: Competency Skills

Competency Skills	Metrics
Problem solving skills	Flowchart design
Logical skills	Pseudo Code
Debugging skills	No. of Errors
Creative Thinking	Problem Analysis Chart (PAC)
Analytical Thinking	Final Assessment Test (FAT) marks
Conceptual Thinking	Practice assessment Test (PAT) marks
Self - Efficacy	Consistent Mark Score
Time management	Time taken to solve a problem

4. Results and Analysis

As shown in *Figure 1* the three different colours of bar graphs represent the results obtained by processing the data through three different machine learning models, of which ANN had the highest accuracy, followed by Naive Bayesian and then Logistic Regression. Hence we can assume that the blue bars in Figure *2* gives us the most accurate representation of statistics. The results in the above figure show that the highest probability of students is having commitment to achieve task and only few people are categorized as technical, time management skills, consistency, and debugging skills and the remaining strength of students have conceptual, creative, logical, analytical.
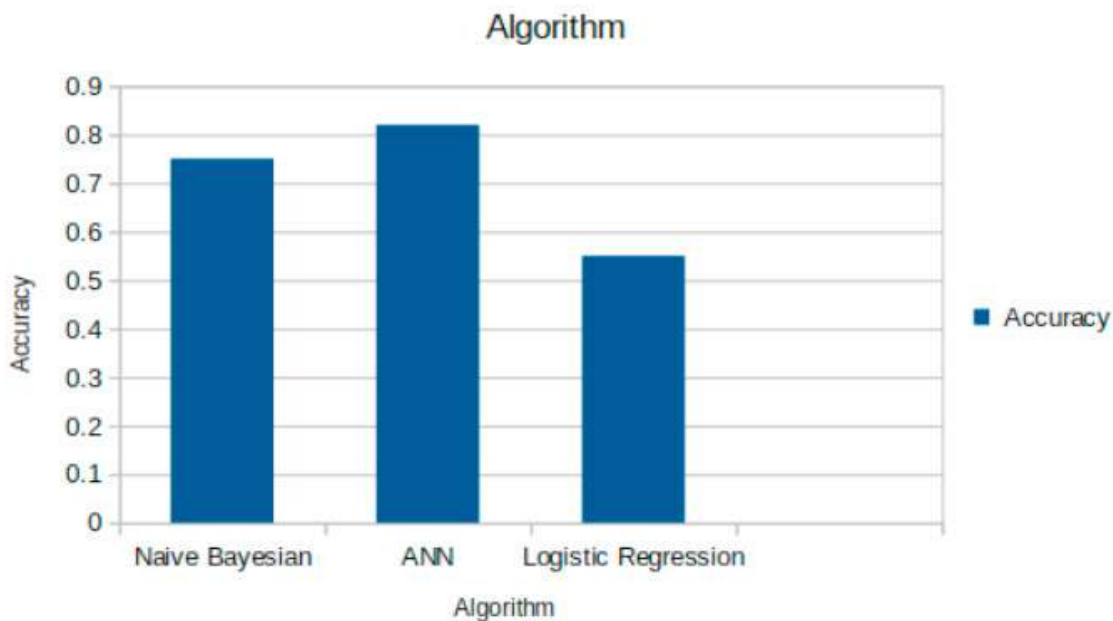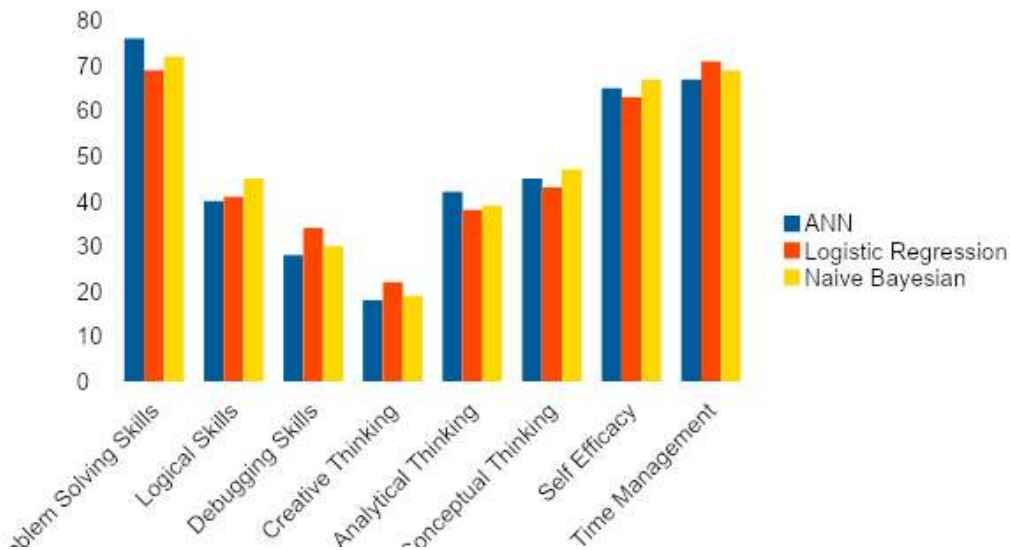

Figure 1: Comparison between Algorithms

Figure 2: Comparison between Competency Skills

5. Conclusions and Future Enhancements

We can conclude from our project observations that we have successfully evaluated a student's competency levels through the assessment marks obtained from the SkillRack. We can use this competency model for analysis of competences for the students of other institutions also by taking their assessment marks from different types of tests and display the results finally as a graph in the end for feedback of the results. And from the survey, we found that some of the competences are most important for a student to be a lifelong learner and to survive in the IT field. Levels of achievement of those skills are assessed and the results are plotted as graphs. From this, we can say that our university stands in a good position in acquiring lifelong learning skills. We are currently assessing the marks of first year graduates who have undertaken the python programming lab course in order to assess the skills achieved by a person to work in the software field. As our future enhancement, we are planning to extend this assessment among the students of other branches like electrical engineering, mechanical engineering and civil engineering. We plan to add some other attributes that helps in assessing the skills required by the students of different fields and even they can predict their competency level and can improve themselves and universities can raise the employable students and lifelong learners.

References

[1] Lisa D. McNair, Using e-Portfolio to Define, Teach, and Assess ABET Professional Skills, October 28 – 31, 2006, 36th ASEE/IEEE Frontiers in Education Conference

[2] R. Culver, Preparing Students for ABET a – k, October 19 – 22, 2005, 35th ASEE/IEEE Frontiers in Education Conference

[3] Diane Bondehagen, Evaluation of a New Approach to Life-Long Learning in Civil and Environmental Engineering Curricula, 2014

[4] Recep Cengiz Akçay, Evaluating the continuing education centres in terms of lifelong Learning, 5th World Conference on Educational Sciences - WCES

[5] Nurhayat Çelebi, Studying level of awareness of teachers in terms of their lifelong learning skills, 5th World Conference on Educational Sciences - WCES 2013

[6] Fezile Ozdamlia, Hasan Ozdala, Life-long Learning competence perceptions of the teachers and abilities in using information-communication technologies, 4th world conference on educational technology researches, wcetr-2014

[7] SnezanaJovanova-Mitkovskaa, DijanaHristovska, Contemporary teacher and core competences for lifelong learning, 2011

[8] Michael Schumm, Required Competences in Software Engineering, pair programming as an instrument for facilitating life-long learning