The approach to enquiry based inductivelearning practice engineering education of the Datamining

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Abstract: Inquiry based Inductive learning methodology is one of the best technique especially for the engineering students who are expected to solve real world problems. But it is very difficult to standardize a particular learning methodology for an institution with diverse attitude, diverse characteristics, diverse languages, diverse financial back grounds, and diverse cultural scenario with variable educational standard of the students. As the teaching methodology depends on the content and time as well as learners' varied style of learning, the same learner may prefer inductive teaching for one topic and deductive approach for the other topic. This paper initiates a sample study that is taken for a particular institution, in the particular environment, for the particular batch and particular set of students. The sample data are collected from a classroom by distributing the questionnaire attempted by two different batches of student having questions pertaining to Inquiry based and deductive learning. The system is developed and tested twice after teaching the content using inductive method and implemented using attribute relevance, discriminant rules of class discrimination mining. The results are visualized through bar charts and shows that the two batches of learners of different years have different learning characteristics.

Index Terms— Introduction, Models of learning,Dscrimination mining,Inquiry based learning,Implimentation.

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1 **Introduction** :

I.   The Teachers role is to lecturing the students in a natural method of doing and transmitting the knowledge. The students' role is to absorb the knowledge in a constructive way without misconception [1]. In order to meet the needs of divorce learners, it is important to have an approach to teach the content. According to the survey, there are two kinds of teaching approach i.e. Deductive and Inductive [3, 4]. Deductive teaching is highly structured contents that create optimal learning, also called direct instruction. Inductive teaching is the knowledge acquisition from the learner's experience, also called the inquiry teaching. Inductive teaching methods motivate the students by providing authentic problems [6, 7, 8] and case studies, also make the students active in the classroom while engaging them in the task and creating interest on the subject [9]. In inductive instruction, a teacher must present such kind of information relating to the situations, problems and issues where students can correlate to their existing real world structures. There are varieties of approaches to teach the content in inductive ways but the instructor involvement may be less or high. Sometimes the classroom learning is not sufficient that requires outside exposure of the laboratories

Generally the students are inclined to three ways of approach [9] let us discuss.
Surface approach: students memorize the content and reproduce the same in the examination to get maximum score. Also they memorize the formula and they are less bothered about the content that taught in the classroom. • Deep approach: students are curious to explore the new material, probing and questioning. • Strategic approach: students are focused to get highest grades doing whatever necessary, start from surface approach to deep approach as per required.

The teacher should concentrate on deep approach [2] while continuing instruction relating the subjects to the personal and professional development. It is also assumed that students adopt an approach which is to growth and promote the intellectual is the deep approach.

Instructors may have vast experience and wide approached skills of learning methods but two instructors with same method of learning in two different classes will get different results and two instructors using the same method of learning in the same class could get different results [4]. In this paper, a system is developed in order to know the kind of learner available in the classroom [5] that guides a teacher to proceed with an appropriate learning methodology. The organization of the paper is follows in the next sections: section 2 discusses the various kinds of learning models available in the globe; section 3 elaborates specifically the inquiry-based learning methodology; section 4 present the class discrimination mining whereas questionnaire data has been collected from the students in a classroom and the attribute relevance analysis followed by data generalization; section 5 discusses the implementation details with the results in the form of discriminant rules and Bar charts in order to help the teacher followed by summarizing the work; section 6 provide the concluding remark.

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MODELS OF LEARNING:

The basic and the simplest instructional methodology noticed to current trend of learning coined as blended learning. The blended learning [10] includes face to face classroom methods [5] as well as computer mediated activities so called online teaching methods [8]. There are four kinds of blended learning models a teacher should know like the flipped classroom model, the flex model, the lab rotation model, the station rotation model.

The flipped classroom model is a reverse learning approach of classroom time in the traditional approach. In this model, classroom time is utilized to encourage the students by providing one to one help instead of

lecturing to students. This way of learning improves student and teacher interaction where teachable content is still available in the class. The content is designed in such a way that can be accessed outside the class and students to learn at their own pace. In summary the classroom is only for the discussion among the student and teacher.

The flex model insists more towards online learning that becomes backbone of a students learning. Each student has a schedule and the respective teacher will be on the site. The face to face support provided to the students as needed basis through a small group instruction, group projects and individual tutoring. Students move flexibly through different learning modalities in order to optimize their learning experience based on their need [4].

The lab rotation model focuses the rotation of students between a classroom and the computer lab at a fixed point in time. The classroom is reserved for discussions and answering the questions raised by the students. The computer lab used by the students to learn predominantly online.

The station rotation model facilitates more than one learning station where students rotate at fixed point of time among them. The learning stations include at least one online learning as a station, small group as a station, full class instruction as a station, group projects as a station, individual tutoring as a station and pencil-paper assignments as a station. In this model, students rotate through all the stations. There is a small difference among the station rotation model and the lab rotation model mentioned here for more clarification. In station rotation model, students are rotating within a given classroom whereas in the lab rotation model students are rotating between classroom and the learning lab where they do online learning.

INQUIRY BASED LEARNING:

Inquiry-based learning is engaging the students to investigate the topic related questions in the interests of the students. However, by selecting meaningful questions and investigating meaningful answers, a student will share knowledge with others to become a lifelong learning. A student is going to apply the acquired knowledge to the real world situations. It is a student centered learning methodology or teacher guided teaching methodology.

II. This approach is student centric learning approach where the teacher presents a variety of examples for a given concept without giving any preamble about how the concept is used. The student will notice how the concept is to be used and determine the abstract rule. The teacher then asks the students to explain the abstract rule as a final check that they understand the concept. It is like a cyclical process of asking questions followed by the answer where the student will have desire to do that (problems followed by solutions). The result is creating hypothesis and exploring to test the hypothesis or find the answers to the questions. In this process students are creating the new knowledge or investigating the answer to generate new knowledge. So students are discussing about the newly acquired knowledge that reflect to generate more questions and further exploration of questions

Inquiry-based learning is an interconnected nature of knowledge construction for both teachers and students to collaboratively build, test and reflect on their learning. Teachers are the learning facilitator where the students are the learning element of interest. Teacher teaches the problemsolving [10, 11, 14] critical thinking skills [13], disciplinary content and learning style and build self supported learning skills. Students may analyze, acquire information, develop and provide solutions. They may design some technology and products that demonstrate their ability of thinking and prove their learning sustainable [14].

CLASS DISCRIMINATION MINING:

The data samples are collected from the two batches of students in different year say batch1and batch2. The analysis [15] to the sample data collected from the students is of two ways. First, the questionnaires [16] provided to the students and collected data samples stored in a table. Second, the table split into target

class that belongs to inquiry based learning and contrast class that belongs to deductive learning for discrimination mining. Each table contains five attributes though it has a set of five questions each.

A. Questionnaire data:

The questionnaire contains 5 questions of inquiry based learning as well as 5 questions of deductive learning is given below:

a. How often you want to involve actively in solving real time problems? b. How often you want to ask questions to the teachers? c. How often you want to answer the questions? d. How often you want to investigate to find answers? e. How often you want to communicate the learning with others? f. Do you expect the teacher to introduce the concept and solve the problems? g. Do you expect a question from the teacher? h. Do you expect the answers from the teacher?

C. Data Generalization:

The rating provided by the student for a question belongs to 1 or 2 is generalized to 1 and the rating provided by the student for a question belongs to 3 or 4 is generalized to 4 that are maintained in target class as well as in contrast class. The missing values are filled by the mean value of the questionnaire. We further generalized and kept the data in a prime generalized relation table for the target class as well as contrasting class. The rule for generalization is say if there are a minimum of three 1s that are present in a tuple, the other attribute values are generalized to 1. If there are a minimum of three 4s that are present in a tuple

IMPLEMENTATION:

The data mining approach is implemented [17] and the learning system is developed that calculates the gain values for all the attributes with a given data. According to the Gain values the highly relevant attributes for the analysis are selected i.e. the highest gain value of the attribute is highly relevant. The calculation is made for five attributes that are shown in table 1 and 2.

A. Presentation of Class Discrimination Let qa be a generalized tuple and cj be the target class, where qa covers some tuples of target class. the d_weight (discriminant weight) for qa is the ratio of the number of tuples from the prime generalized relation for the target class that are covered by qa to the total number of tuples in both prime generalized relation for the target class and prime generalized relation for the contrast class that are covered by qa.

The observation is made for the prime generalized relation of both the tables and counts the generalized tuple with by definition (1) and generalized tuple with possibly (4) for batch1. The result of d_weight for a generalized tuple with by definition (1) is 53% with respect to target class and 47% with respect to contrasting class. Also the d_weight for a generalized tuple with possibly (4) is 47% with respect to target class and 53% with respect to contrasting class. So there are two quantitative discriminant rules presented below

B. Result Analysis:

The analysis is made for both the batches and the graph is presented by removing one attribute at a time based on threshold and considering remaining attributes. The percentage of students like and do not like the learning methodology with respect to remaining attribute based on threshold values of batch1 students are shown in Bar charts 1, 2. The analysis report states that most of the students do not want to find the answers from the available material. They fear to ask questions in the classroom and do not want to involve actively in the class room problem solving. Still they have courage to answer the questions and want to share their knowledge with their peers.

The percentage of students like and do not like the learning methodology with respect to remaining attribute based on threshold values of batch2 students are shown in Bar charts 3, 4. The analysis report states that most of the students expect the teacher to introduce the concept and solve the problems in a deductive manner. Most of the students expect all the answers from the teacher and they do not want any

type of questions from the teacher. Majority of the students like to isolate their learning with others. They mostly like deductive way of teaching and learning.

C. Result Discussion:

The analysis is made on the data sample of batch1 students and the result found as 53% of learners would like to pursue inquiry based learning methodology and 47% of learners would like to pursue Deductive learning methodology. Also we got another result that the 47% of learners do not like to pursue inquiry based learning methodology and 53% of learners do not like to pursue Deductive learning methodology. Now if a comparison is made between both the discriminant rules then discriminant rule-1 is preferred that is inquiry based learning is preferred. However, the discussion says that there are 53% of the students would like to pursue inquiry based learning methodology means there are 47% of the students do not like to pursue inquiry based learning methodology other way. In continuation, if it is compared with the discriminant rule-2, it is found that 47% of students do not like to pursue inquiry based learning methodology which is matching with discriminant rule-1.

CONCLUSION:

The study of last two batches of students in different years of sample data shows different results. The comparison of two batches of students' states that the batch1 students are inductive bent of mind while batch2 students are deductive bent of mind. When teacher want to adopt inquiry based learning methodology, it is appreciated by the batch1 students but not batch2 students. So it is the responsibility of the teacher to make a survey before the semester starts, however by distributing the questionnaire that is given in this paper. This paper helps a teacher to obtain the percentage of students like the appropriate learning methodology; accordingly the teacher can start the session as inductive or deductive way. In future the analysis continues with different set of students and tries to justify its appropriateness

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