



A PREDICTIVE SYSTEM TO EARLY PREDICT STUDENT FINAL PERFORMANCE.

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Abstract : One of the important and challenging issues for educational institutions is the prediction of students' performance. The attainment of learning outcomes, at the course level, is performed using direct and indirect assessment methods at the end of the learning process. The timely prediction of student performance enables the detection of low performing students, thus, empowering educators to intervene early during the learning process and implement the required interventions. It is possible to predict final students' performance beforehand thanks to performance data supplemented with each unit (related to learning results). The cumulative GPA and course assessments are the most used predictors of student performance and success. In this work, the performance of the student is examined that predict the attainment of student outcomes and help to identify the slow learners which may lag others in terms of their academic performance and need special attention during the program.

Keywords: Performance, Slow learner, Education, Prediction, Assessment, Ontology.

I. INTRODUCTION

Assessment allows both teacher and student to measure progress towards achieving learning objectives, and can be approached in a variety of ways. The work help student to shape learning, and can even strengthen students' abilities to take ownership of their learning when they understand that the goal is to improve learning, not apply final marks (Trumbull and Lash, 2013). In short, assessment occurs throughout a course, and seeks to improve student achievement of learning objectives through approaches that can support specific student needs. (Isrorani, 2022) uses a quantitative approach to calculate the average value of student learning outcomes.

Measuring student outcomes indisputably brings about various benefits, including the establishment of program expectations for students and course instructors. The world's 60 million teachers who ask, "What can I do right now to improve learning in my classroom?" (Twyman and Heward, 2018) describe three easy-to-use teaching tactics derived from applied behavior analysis that consistently yield measurably superior learning outcomes. (Bai,Hew, & Huang, 2020) examine the effects (if any) of gamification on student learning achievements. (Abuhassna et. al, 2020) illustrates eleven factors on using online learning platforms to improve students' academic achievements and satisfaction. A learning strategy training program including a remediation track for lower performing students can thus support students to study more effectively and enhance equal chances for all students at university (Biwer, Bruin & Persky, 2022).

In this work measurable student outcomes are developed to improve the quality of learning processes and educational programs. Effectively, these outcomes assess what students can perform with what they have learned. The attainment of learning outcomes, both at the course and program level, is performed using direct and indirect assessment methods at the end of the learning process. To calculate the attainment rate of outcomes, one should identify a priori the attainment targets and levels and then properly align student grades to the appropriate attainment level. (Ervianti, Sampelolo and Pratama,2023) aims to determine the influence of digital literacy on the learning outcomes of students of the Educational Technology study program at the Indonesian Christian University of Toraja. AI performance prediction model is widely used to identify at-risk students that tend to fail, establish student-centered learning pathways, and optimize instructional design and development (Ouyang et. al, 2023). (Desimone, 2023) focuses on content or how students learn content, opportunities for active learning, participating collectively with other teachers, ensuring coherence with school and organisational-level mandates and teacher beliefs, and learning activities of sufficient duration to allow practice and feedback.

The system proposed obtain a unit wise performance of each student's probability of belonging to one of these two classification levels: slow and fast learner. This work is aim to understand the landscape of student outcomes prediction using data mining, identify the main challenges hindering the prediction of student outcomes, and propose relevant recommendations. It will also help you to identify the slow learners among

the students. Finally, the predictions are offered to the teachers in the form of graphs in the course ontology with each unit class that present a progressive view of performance predictions, producing valuable information about the evolution of students learning activity and expected performance through ontology.

II. DATASET

It is crucial to transform the data into valuable information that can give advice for teachers about progress of the students. Building some informative characteristics well correlated with student performance and evolution is crucial to get good prediction results, so the first step is designing which information would be valuable to log. To make up the set of learning data, all learning results from internal marks of student (CA + DHA) of the specific course are collected and further classified (percentage obtained < 60) based on their performance as slow learner. These learning outcomes are qualified as potential predictors because of their intuitively logical relationship with the final performance. So that teacher can monitor the progress of their students and can improve their final performance from the curriculum management system. For each unit 3 DHA and 2 CA performance are measured for the student of course CSM 101. From the CA and DHA marks percentage are calculated to measure the unit wise performance of the students. The other criteria to classified student as slow performer based on their attendance. The availability of student in class will affect its external performance.

Table 1. Performance of Students

Student name	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5	TOTAL
S1	52	48	56	56	72	56.80
S2	76	64	80	54	66	68.00
S3	80	64	88	66	44	68.40
S4	48	82	40	80	76	65.20
S5	66	44	58	60	70	59.60
S6	58	62	76	44	46	57.20
S7	56	64	74	58	74	65.20
S8	72	48	56	54	70	60.00
S9	56	56	64	56	52	56.80
S10	66	32	42	56	72	53.60
S11	88	60	60	58	60	65.20
S12	56	64	64	70	62	63.20
S13	72	72	72	68	34	63.60
S14	72	60	64	64	72	66.40
S15	72	62	64	58	62	63.60
S16	84	68	80	70	72	74.80
S17	56	48	44	52	52	50.40
S18	70	58	64	54	74	64.00
S19	72	66	60	60	72	66.00
S20	46	44	34	42	64	46.00
S21	66	84	60	58	82	70.00
S22	76	60	72	60	82	70.00
S23	76	64	72	76	76	72.80

2.1 Course Ontology

This section presents the curriculum ontology developed to cover the syllabus of the course. In this study the course CSM 101 of physics and computer science department of the Dayalbagh Education institute has taken. Assessment occurs throughout a course, and seeks to improve student achievement of learning objectives through approaches that can support specific student needs. The course component considered to be associated with student success are:

- Presence of centralised program organizational structure.
- Presence of mandatory assessment of students.
- Availability of tutorial services.
- Availability of counselling services.
- Presence of program evaluation.

The work provided a curriculum management for course CSM 101 to fulfil the above requirements. The syllabus ontology is developed using Protege to guide the student with the course coverage. In this chapter measurable student outcomes are developed to improve the quality of learning processes and educational programs. Effectively, these outcomes assess what students can perform with what they have learned. The attainment of learning outcomes, both at the course and program level, is performed using direct and indirect assessment methods at the end of the learning process. The course is classified unit and lecture wise representing the classes and sub-classes in the ontology that will help teacher and student to cover the syllabus accordingly.

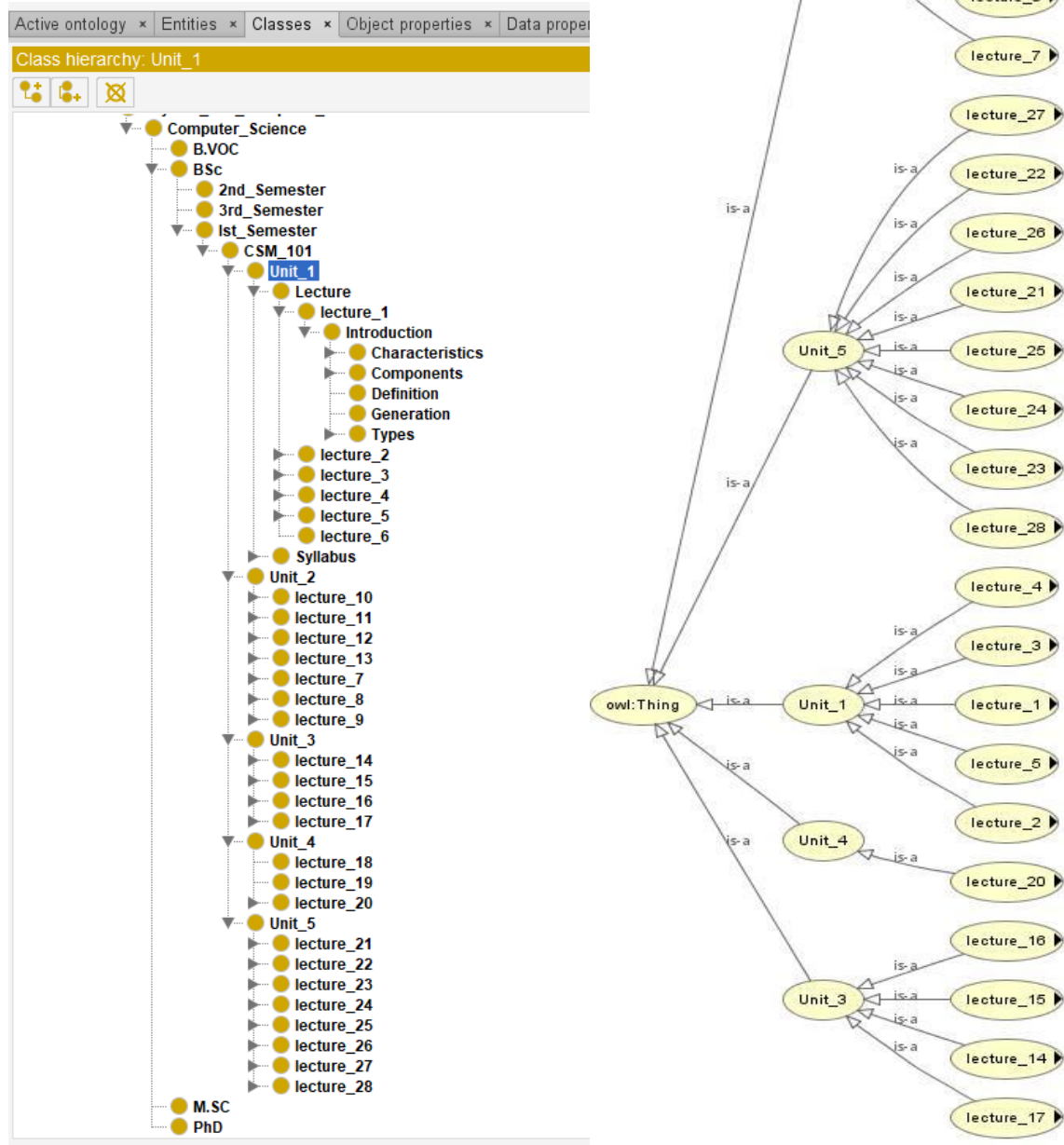


Figure 1: Course Ontology

III. RESULT

Every student is unique, that is why some may perform well in some subjects while others may not. Each student will be different from other students and can showcase different talents and creativity. In this group of students, some may fall behind from others in terms of their academic performance. Some students take more time to grasp learning topics, these students are slow learners. There will be some students who are slow learners in every class. From the above data metrics, the students are classified between slow and fast learner. All the students below 60% are considered as slow learner. However, with some extra care and attention, these slow learners will be able to keep up with other students and can improve their performance in external exam. Teacher than can modify the pedagogical methodologies to improve the performance and keep them on the same page as other learners.

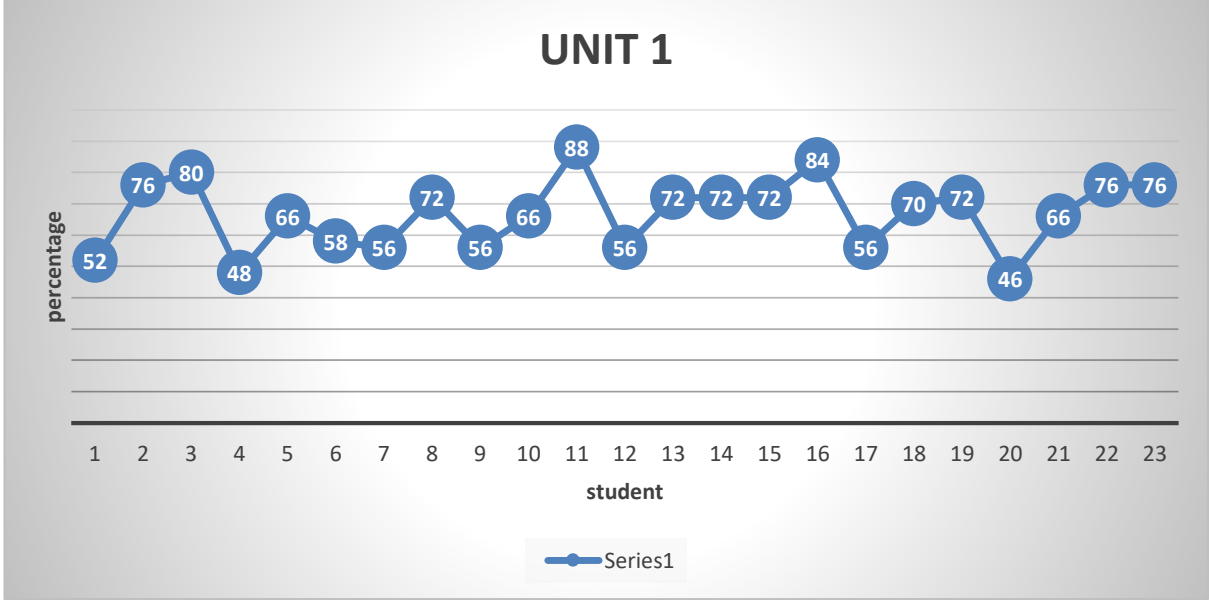


Figure 2: Unit 1 performance of student

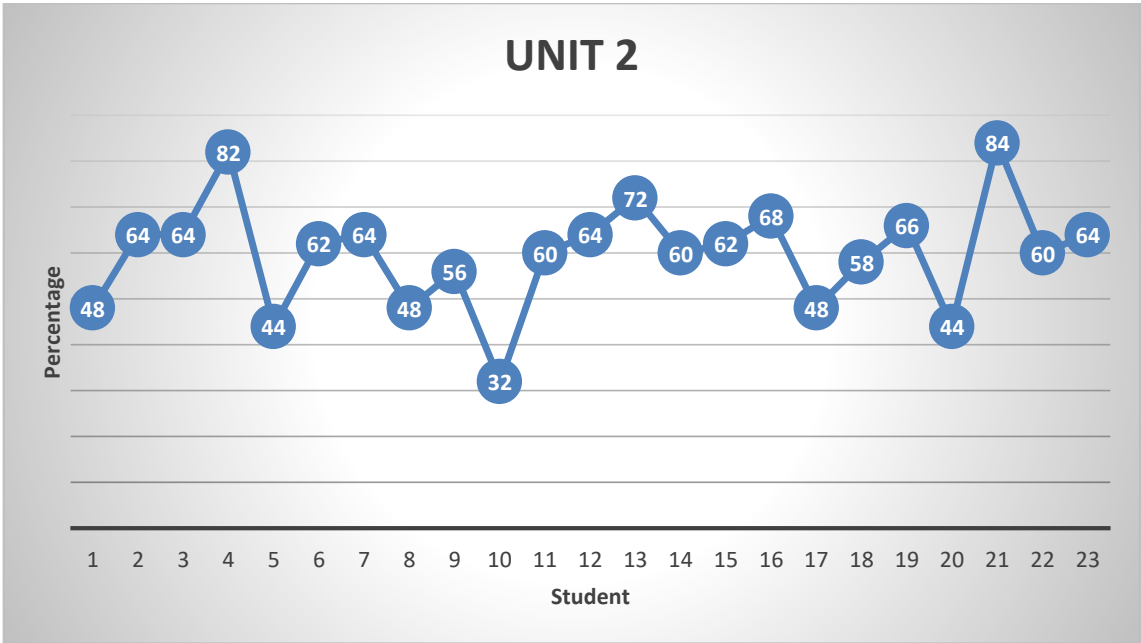


Figure 3: Unit 2 performance of student

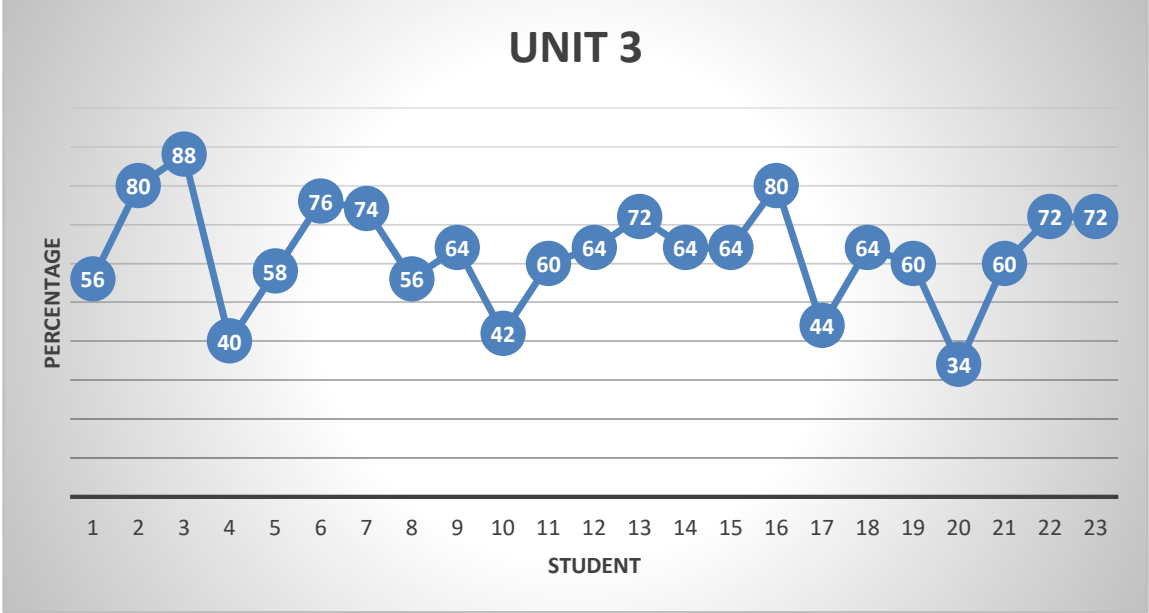


Figure 4: Unit 3 performance of student

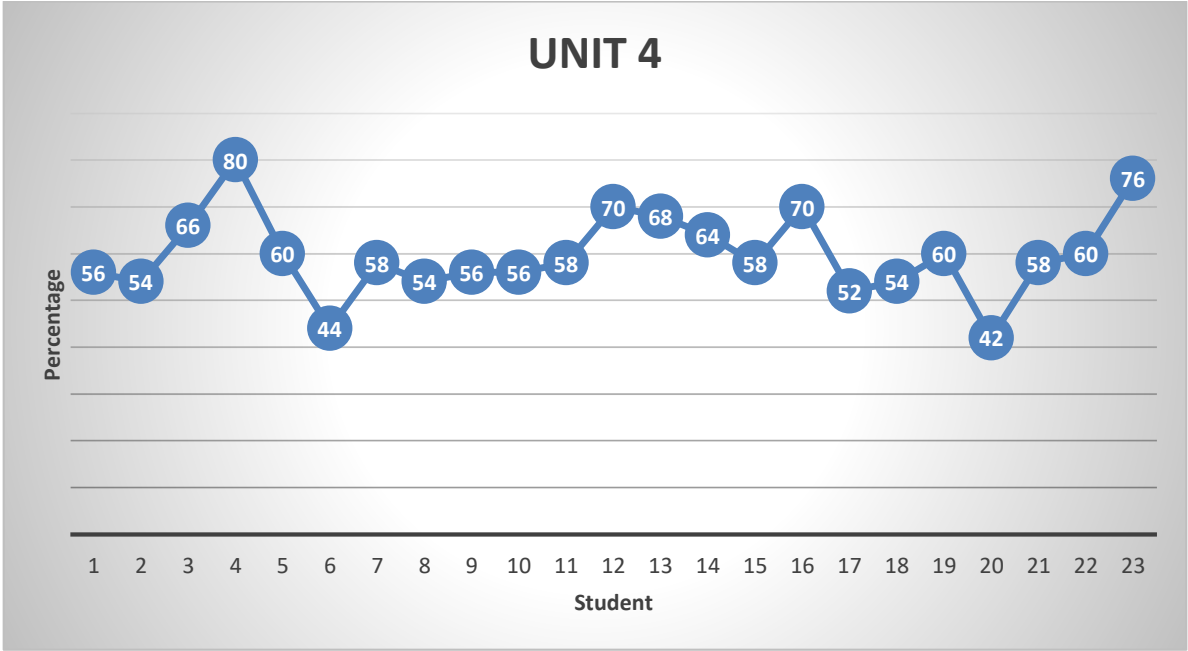


Figure 5: Unit 4 performance of student

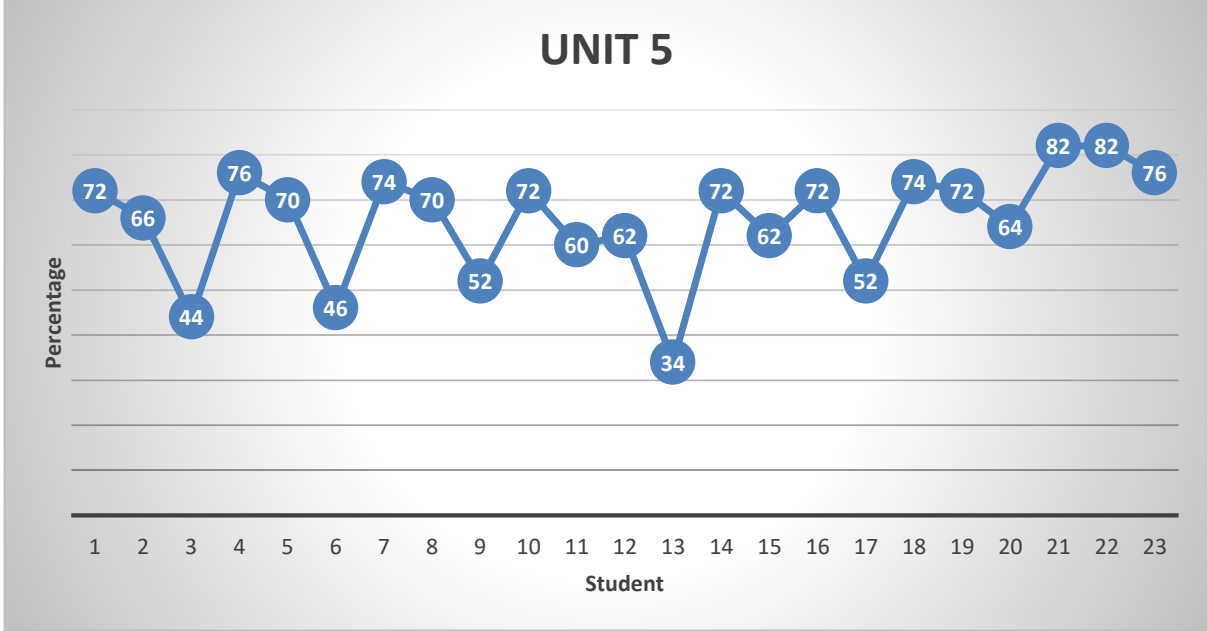


Figure 6: Unit 5 performance of student

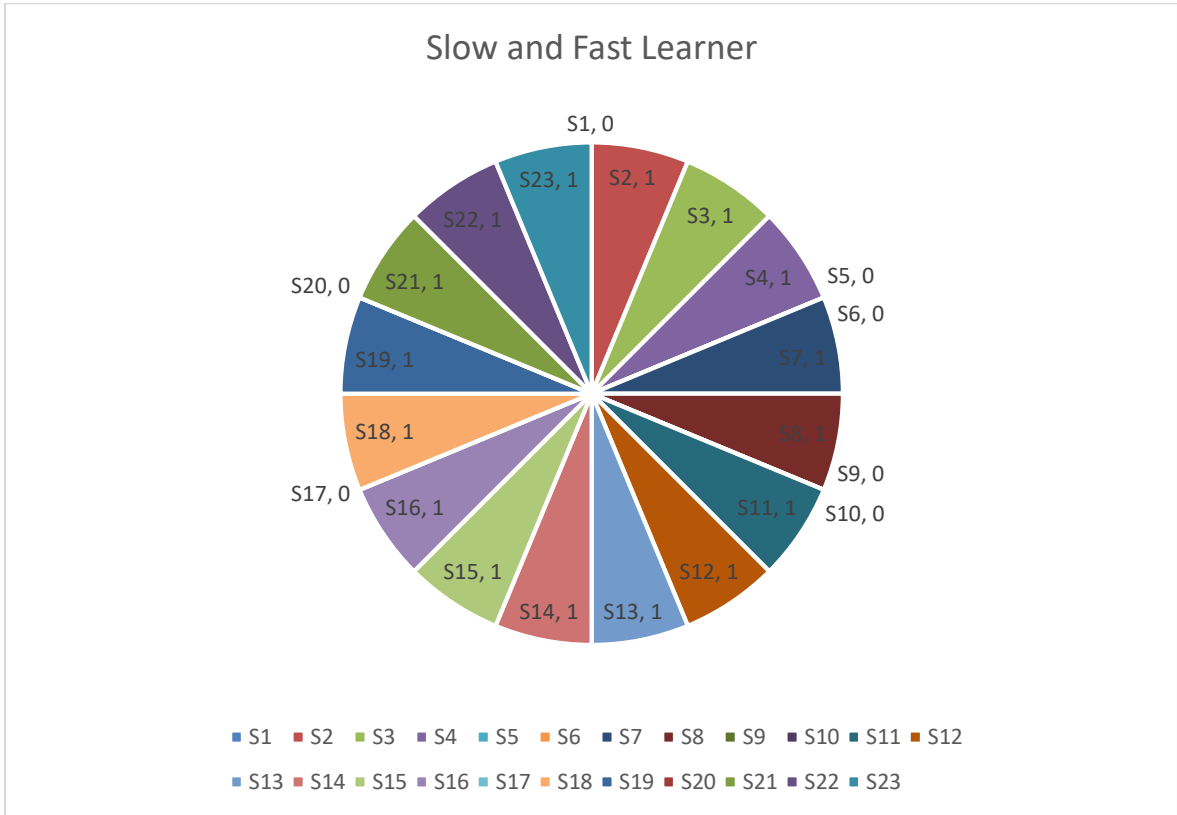


Figure 7: Chart representing slow and fast learner

The above chart shows the classification of student as slow and fast learner. The slow learner is coded with number ‘0’ and fast learner as ‘1’. All the students with code 0 - s1, s5, s6, s9, s10, s17 and s20 are considered as slow learner and need measure to improve their performance. The reason which affects their performance can be many. These are some of the characteristics that can used to identify the

reason behind the student slow performance. It is important to do so because through this a significant change in their performance and uplift them, bringing them to their fullest potential. Teacher can adopt various strategies to help them overcome their difficulties.

IV. STRATEGIES TO IMPROVE PERFORMANCE

Problem: LACK OF ATTENTION IN CLASS DURING LECTURES

Slow learners have difficulty in focusing on lectures being given in class because of low concentration power and can easily get distracted by their thoughts and other external factors. It's hard for them to concentrate in the class for a larger period of time and hence may miss out on important topics of the lectures.

Solution:

- Teacher should include interactive discussions, preferably at the end of the class and between the lectures to make sure that the students are following the concepts.
- Teacher should try to make the lectures more interesting in order to grab the attention of such students and keep them engaged in the class for longer.
- Teacher should make use of active learning as it improves knowledge retention among students and can have a significant impact on their scores.
- Once they start relating the concepts to real-life situations, it will be easy for them to learn the concept in the best possible way that they will never forget. Active learning can maximize their learning potential & increase their interest in learning.

Problem: Apprehension Difficulty

Student have difficulties in understanding written or spoken information. Slow learners cannot comprehend the topics being taught in class as they cannot participate in the class actively and are unable to comprehend ideas and words that are used by the lecturer. This can lead to poor performance from the learners. A lack of understanding of the topics that are discussed in the class can degrade their performance. Unless and until a learner is unable to understand a concept, they will not be able to score well in exams.

Solution:

- Remedial classes can be organized for the slow learners so that their problems can be addressed in a separate class at their own pace as it provides students with a comfortable learning environment and gives teacher an opportunity to closely analyzed the students' problems and guide them properly on how they can improve.
- Teacher should ensure not to burden the students with a lot of information and making it hard to follow the lectures.
- They can use different pedagogical methodologies that would work for different type of students differently. Once, they realize their potential they can perform better, and will develop intrinsic motivation and start showing interest in learning.

Problem: Difficulty in Expression

Because of holistic understanding of the learning concepts slow learners will not be able to properly answer questions in an exam. They frequently have trouble making connections with teachers so it became harder for them to communicate their thoughts clearly. Even in the classroom, these students might not have the skills to clearly communicate their views. This affects their overall performance and scores. Student with this disorder me have trouble in:

- Understanding what teacher say.
- Understanding concepts and ideas.
- Understanding what he or she reads.
- Learning new words.
- Answering questions.

Solution:

Peer Mentors can assign to these types of students to help these learners in the classroom. Students taught by cooperative learning achieved greater academic performance in the form of higher exam scores (Yamarik, 2010). It will be comfortable for them and they may find it easier to grasp the concepts from their peers. As they use the friendly way of teaching because they belong to the same age groups and the choice of words and instructional methodologies may vary. They might be able to break down the complex learning topics into manageable simple bits that may facilitate the learning process of the students who are lagging.

Problem: Poor Grasping Power

The student with poor memory power has relatively low learning retention because of that they forget the learned concepts easily and it is not easy for them to remember formulas, important concepts, definitions, and other important data to apply them when required. This substantially affects their overall performance.

Solution:

Special learning exercises can be prepared to help the students get a hand on the topics that are hard for them to comprehend. Allow them to go through the concepts, starting from the basics, if required. When they eventually comprehend the topics, it may develop confidence in them and inspire them to accommodate the complexities of those topics and eases the process of understanding.

Problem: Weak in Coherent Intellectual

Everybody is uniquely empowered for unique roles and responsibilities. One may be good in thinking and analysis, another may not. One may be sharp and fast to grasp, some may be slow. Slow learners have low rational thinking capabilities. It is difficult for them to make

informed decisions and to analyze a situation and act accordingly. It is also difficult for them to evaluate the pros and cons of a problem before reaching a conclusion for the same and may seek help from others to decide on something since they personally would not feel confident to take decisions on their own.

Solution: Appreciate the achievements of such type of students to build up their confidence, even if they are small. It motivates them to perform better and improve their performance. It is the lack of motivation that takes away interest in learning among students. Therefore, it would be a good idea to appreciate them even if their performance is improving at a slow pace. Remember, these small rewards can have a great impact on their outlook toward learning.

Problem: Irregularity

Student who are frequently irregular are at serious risk of falling behind. Chronic irregularity rates are higher in higher studies and it is a big issue in many educational institutes. In the early grades poor attendance can delay social and emotional learning. It stands as barrier to all round development of a child. An irregular student is unable to make it academic career successful. As their irregularity will affect their overall performance and accordingly to institute rule are not allowed to participate in the final exam and miss out the DHA and CA marks which will also affect their internal performance. From the given box- plot chart (figure 6.7) it can be seen that the performance of student missing out more number of CA and DHA has percentage below 60% so irregularity in class is also the reason for the student's lagging behind.

Solution:

- Give the irregular student a chance to respond and positively try to find the genuinity.
- Insist the student to accept responsibility for their behaviour and help them to be regular.

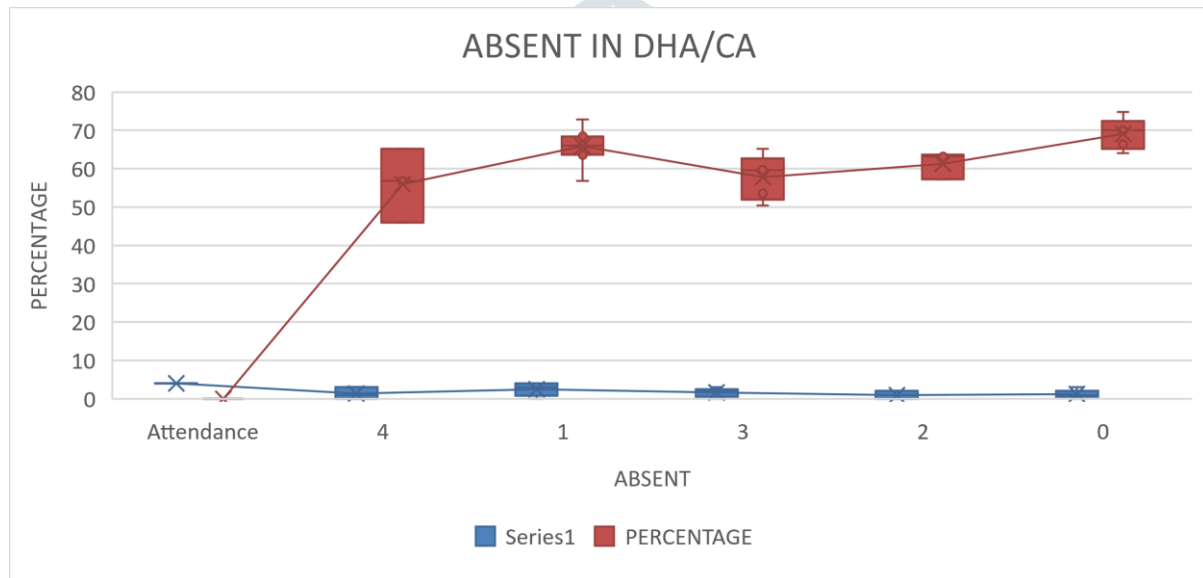


Figure 8: Absent student

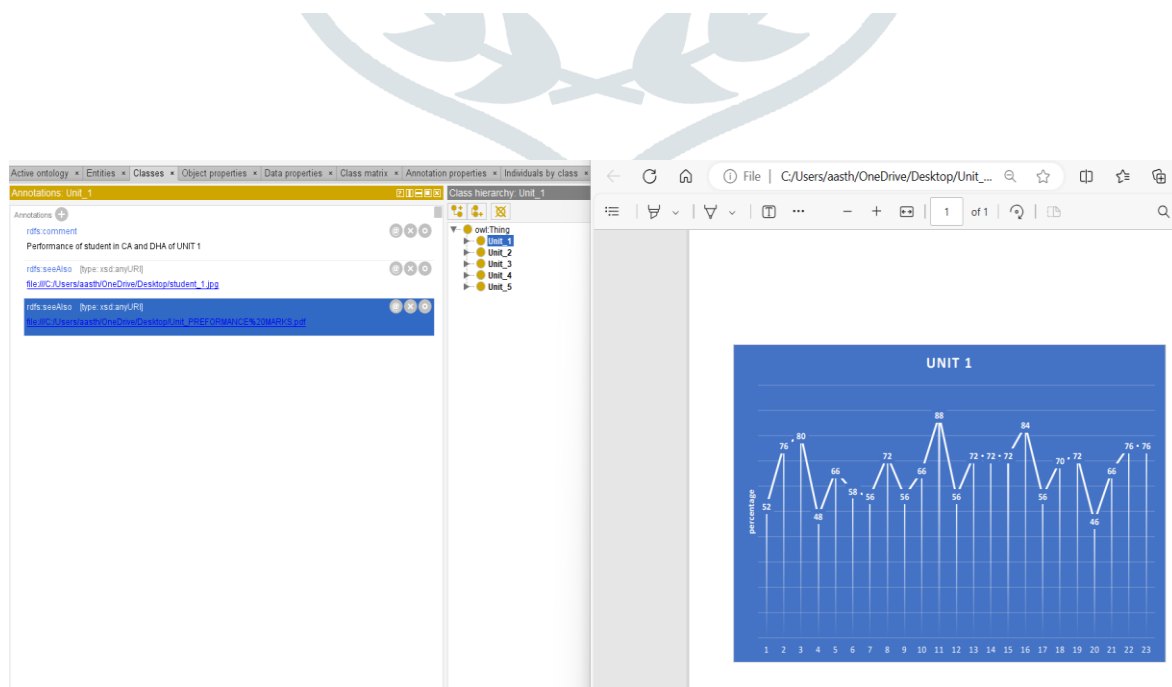


Figure 9: Performance of student shown in Course Ontology

V. CONCLUSION

One of the important and challenging issues for educational institutions is the prediction of students' performance. This work predicts the unit wise student performance and classify them as the slow and fast learner. So that the slow learner in class can focus on their studies to improve their performance in final result. A course ontology is also introduced to represent the syllabus of the course which will help student to cover the syllabus for the exam. It also suggests measure to improve the performance of the slow learner which can be followed by teachers and students for performance improvement. Measuring student outcomes indisputably brings about various benefits, including the establishment of program expectations for students and course instructors. The timely prediction of student performance enables the detection of low performing students, thus, empowering educators to intervene early during the learning process and implement the required interventions. It is possible to predict final students' performance beforehand thanks to performance data supplemented with each unit (related to learning results).

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