ANALYSIS OF THE EFFECT OF CLASS ATTENDANCE ON STUDENTS'ACADEMIC PERFORMANCE USING ASSOCIATION RULE MINING TECHNIQUE

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Abstract

Many institutions of learning encourage students to have good lecture attendance records. The belief is that an above average attendance rate will enhance students' academic performance. However, very few studies have attempted to answer questions that relate to: i) the actual impact of good attendance record on students' academic performance; ii) the extent, in quantitative terms, of the effect of good attendance record on students' academic performance. This paper reports the findings from an experimental analysis of students' attendance record and corresponding academic performance results using Association Rule Mining. Over the years, Association Rule Mining has proved to be effective in analysing relationship between variables in transactional databases. The result of the case study provides useful information for the managements of higher institutions of learning on appropriate perspective to adopt on class attendance policies.

Keywords: Association rule mining, student academic performance, class attendance, data mining

1.0 INTRODUCTION

The objective of keeping course attendance record in higher institution of learning is to ensure physical participation of students in their registered courses in order to improve the students' overall performance. At every class, each student is expected to register attendance with a unique identification number and signature. This is the practice in many higher tertiary institutions of learning in Nigeria because it was noticed that academic freedom in tertiary institutions provides students with opportunity to absent themselves from classes [1]. To this effect, in order to students' attendance of lectures, a course evaluation policy have been introduced in some universities, where students who have not met the minimum attendance benchmark for a particular course will not be allowed to attempt the examination of that course .

However, it is difficult to determine whether attendance rates serve as indicators of inherent motivation without an external cause to determined student grade. [2]. For instance an unmotivated student forced to attend lectures, who is unlikely to pay attention or participate in the classes, may end up having poor grades in most courses, because his physical presence in classes did not imply his participation. Therefore, in order to justify the course evaluation policy, there is a need to determine the real impact of course attendance on students' academic performances, and more importantly the extent of its influence in quantitative terms, so as to justify the effectiveness of the minimum attendance rate.

Due to the importance and the interestingness of these concerns, many submissions have been reported in the literature. Several authors have analysed the class attendance and student performance from different perspectives using different methodologies. Some authors strongly support the proposition that class attendance is capable of determining student academic performance based on their analysis. Some of such, that have been reported in the literature are reviewed in this paper. In [3], statistical analysis of variance was used to analyse the student attendance percentage, the overall Grade Point Average (GPA) and the number of credit hours the student enrolled in at specific semester. The authors also used Mintab to analyse their data in order to obtain regression analysis model for the attendance and academic performance analysis. It was concluded from the analysis that the overall Student's GPA and the attendance percentage are the

most significant factors in determining the grade attained in a specific class. Also in [1], an analysis of class attendance and gender effect on undergraduate student's achievement in social studies course in Botswana was carried out. ANOVA and Student's t-test were for the statistical analysis. An Investigation into the Academic Effectiveness of Class Attendance in an Intermediate Microeconomic Theory Class was carried out in [4]. Different analytical models like fixed-effects model (FEM), the random-effects model (REM), and ordinary least squares (OLS) estimation for regression were used and the result showed the strong support for the proposition that class attendance has a significant effect on academic performance. Other analysis in support of the proposition could be found in [5, 6] [7, 8, 9].

In objection to this proposition, Caviglia in [2], investigated the impact of mandatory attendance policies and absentee rates on student performance using OLS and Heckman selection models. The result from the regression analysis indicate that the most significant and consistent indicators of performance are GPA prior to taking the class, prior economics knowledge, and SAT score. Therefore, it was suggested that instructors should encourage, but not mandate attendance in both small and large lecture settings. Also, report from [10,11] indicate that class attendance is not strong alone to affect student academic performance.

From the overall review, it is observed that most of the analysis done were based on statistical analysis which was able to indicate whether good attendance implies good performance but not able to give the extent of the impact in quantitative terms, so as to determine the proper minimum attendance rate for course evaluation. In this paper, an attempt is made to fill this gap by using association rule mining technique.

2.0   METHODOLOGY

2.1   DATA SET

Two data samples of 383 students were considered to investigate the impact of class attendance on student academic performance. The First dataset contains 267 record from a mathematics-oriented course from the Department of Computer Science of one of the Nigerian Universities. The Second dataset contains 116 records from a logic oriented course. The data fields are studentID number, attendance scores and total score, which includes continuous assessment and examination scores. The description of the data set is shown in Table 1.

2.2   Association rule mining

For the analysis, quantitative association rule mining apriori- algorithm was adopted because of the quantitative nature of the analysed data. This was implemented using C# programming language on Visual Studio environment. For the database manipulation and storage SQL Server Management Studio Express was used as the Database management System. The data set was modelled as a relational data model. During the mining process, the attendance attribute and total scores attribute values were partitioned into intervals using equal-depth partition method [12]. Table 2 shows the data partitioning. For the mining process, the relational data set was mapped into the Boolean association rules problems. A new relational table is formulated for each attribute's partition range, such that if the attribute has value in the original record the attribute value will be 1 and 0 if otherwise. Table 2 shows the partition record and Fig.1 shows the Boolean representation of the relational data set. To calculate the vote of each boolean record we use multiplication operator [13]. The interesting measure of support and confidence are used to determine the significance of the generated rules and the confidence [14].

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Table 1: Data description

Attribute	Data description
Matric No.	Alphanumeric
Attendance	Numeric
Total Score	Numeric

Table 2 Attribute value partitioning

Attribute value	range
70-100	A
60 -69	B
50-59	C
45-49	D
<45	F
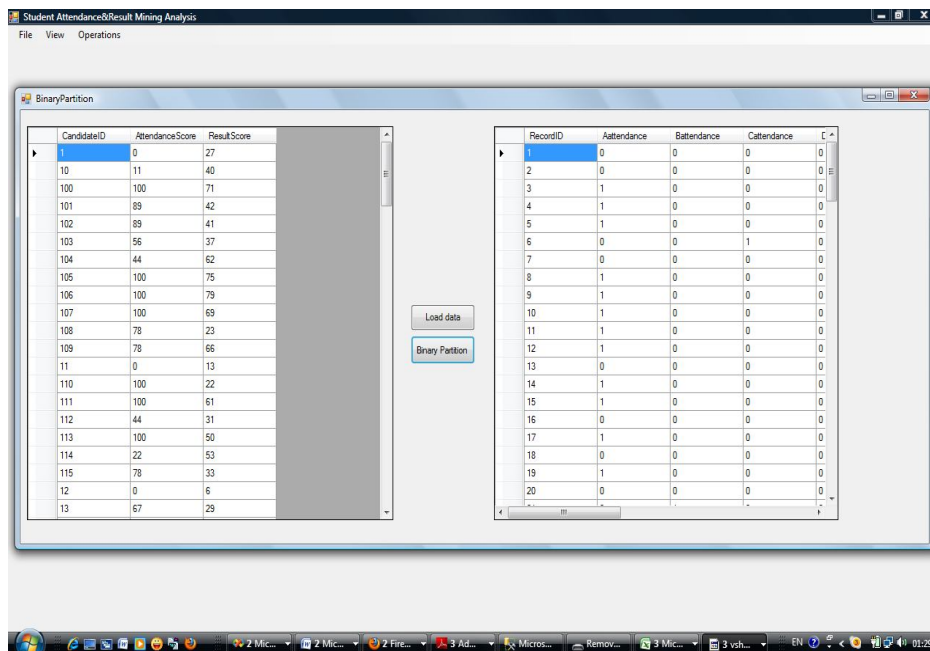
Fig1.: Boolean representation of the relational data set

3.0   RESULT AND DISCUSSION

From the analysis it was revealed that most of the students had 'A' in the attendance, this can be confirmed from Fig.1. Based on the Association Rule Mining analysis performed on the data set the sample of the rules generated from the first data sample is represented in Table 3. This result implies that notwithstanding the class attendance score a student can fall into any category of the result grade. Record one indicate that just 6% of the students scored between 70-100 in the class attendance, i.e. had "A" grade in that course; 11% of the students with 70-100   in the class attendance had grade "B"; 25% had a "C" , 19% had a "D" and 31% had an "F". The relationship between attendance scores and course grades of students is shown in Fig. 2. The rules generated

from the second data sample are shown in Fig.3. From Fig 3., it is revealed that with a non mathematics course a student can also score any grade, regardless of the attendance score. The rule support from (indicated by bullet) Fig.3 revealed that $\rightarrow$ = 0.17. This implies that a greater percentage of student with >70 % attendance still score <45 in the logic course. Nevertheless students with <60% attendance score do not score "A" grade according to record 3-5 on Fig.3

Table 3: sample of the rules generated from the First Data Sample

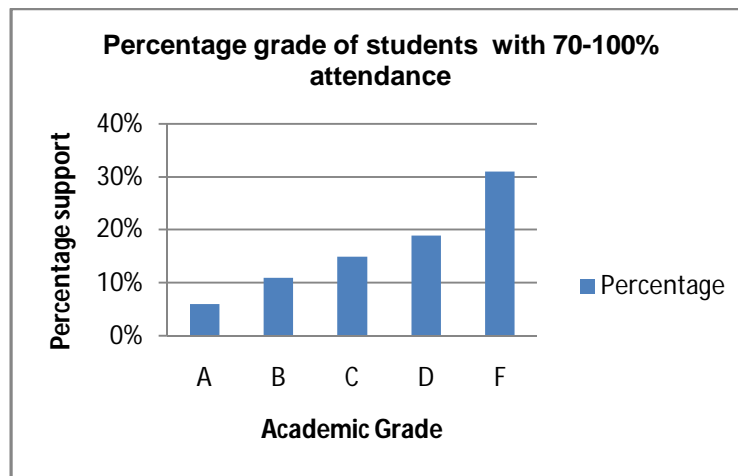| RuleNo.	Rules	Support	Confidence
1	$\rightarrow$	0.06	0.000264
2	$\rightarrow$	0.11	0.000419
3	$\rightarrow$	0.25	0.001054
4	$\rightarrow$	0.19	0.000806
5	$\rightarrow$	0.31	0.001628

Fig.2: Percentage grade of students with 70-100% attendance

4.0   CONCLUSION

Based on the analysis that has been done on the student class attendance and academic performance using association rule mining apriori algorithm in this study, it is obvious that the effect of attendance on academic performance is very low. Therefore, if good attendance records will be mandatory for the students to qualify to be sit for the examination of a course, then the minimum attendance score should not be as high as 70%. Nevertheless any student with less than 60% should not be allowed to attempt the examination. Also, it indicates that there is more to class participation than physical appearance in the class. In future study more factors that can cause distraction to students in the class would   be considered to see their effect on the student academic performance.

Figure 3: Snapshot of rules generated from the second sample

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