

A Suggestive Method in Overcoming the Traditional Grading VS Standards-Based Grading Practices Using Fuzzy Membership Functions and Fuzzy Rules

Dr. K. PRASADA RAO^{*1}, and REKHA.C^{#2}

**Professor, Department of CSE, SEACET, Bangalore, India*

#Asst Professor and Research Scholar, Jain University, Bangalore, India

¹prasudh@yahoo.com

²connect.rrpn@gmail.com

Abstract— Grading is an exercise in professional judgment on the part of teachers. It involves the collection and evaluation of evidence on students' achievement or performance over a specified period of time. Few issues have created with grading and reporting student learning. Despite the many debates and multitudes of studies, however, prescriptions for best practice remain elusive. Although teachers generally try to develop grading policies that are honest and fair, strong evidence shows that their practices vary widely, even among those who teach at the same grade level within the same school.

In this paper, traditional grading system and standards-based grading for dealing with student's learning achievement evaluation are discussed and a new method is suggested by considering its importance, complexity and difficulty by using fuzzy membership functions.

Keywords: traditional grading system, standard based system, suggestive approach, new model grading system, better approach.

I. INTRODUCTION

Over the years, grading and reporting have remained favorite topics for researchers. A review of the Educational Resources Information Center (ERIC) system, for Example yields a reference list of more than 4,000 citations. Most of these references are essays about problems in grading and what should be done about them.

At the beginning of the twenty-first century, lack of consensus about what works best has led to wide variation in teachers' grading and reporting practices, especially among those at the elementary level. Many elementary teachers continue to use traditional letter grades and record a single grade on the reporting form for each subject area studied. Others use numbers or descriptive categories as proxies for letter grades. They might, for example, record a 1, 2, 3, or 4, or they might describe students' achievement as Beginning, Developing, Proficient, or Distinguished. Some elementary

schools have developed standards-based reporting forms that record students' learning progress on specific skills or learning goals. Most of these forms also include sections for teachers to evaluate students' work habits or behaviors, and many provide space for narrative comments.

Looking at the above grading practices, a comparative analysis on the both the system are made to find out the modest method in evaluating the student performance that answers the questions such as :

What is the difference between formative assessment and summative assessment?

What does it mean to grade on student achievement of standards rather than "number crunching?"

Why is it important to separate student behavior and student achievement of standards in the grading process?

II. TRADITIONAL GRADING SYSTEM

Grading and reporting are relatively recent phenomena in education. In fact, prior to 1850, grading and reporting were virtually unknown in schools in the developing countries. They are generally more consistent and much more traditional at the secondary level, where letter grades still dominate reporting systems.. Through this process, various types of descriptive information and measures of students' performance are converted into grades or marks that summarize students' accomplishments. . For example, if a student received an "A" on his/ her report in a traditional system, it could mean any one of the following:

The student had an exceptional understanding of the concepts and knowledge included in the course curriculum, or

The student had only an average understanding, but did lots of extra credit such as bringing in classroom supplies like paper towels and attending school service projects, and had a good relationship with the teacher in class. or

The student demonstrated model behavior – turned in all assignments early, participated exactly as the teacher wanted, was never tardy or late to class

Another example is the other extreme where a student received an “F” on his/her report card. The meaning of an “F” could have so many different explanations -

The student was able to perform well in the class but did not turn in all work and earned 5% according to teachers calculations and received an F

The student was able to perform well in the class but did not turn in all work and earned 59% according to a teacher’s calculations and received an F

The student did not understand the concepts and knowledge of the course

The student had a high level of understanding of the course but was “accused” of cheating and the teacher assigned the student an F

Here evaluation process is overly arbitrary and overly subjective and not clearly explained with the high level of consistency, reliability, and clarity that should be expected of a quality educational system that is standards-based.

Traditional grading practices and its flaws

A traditional grading practice has flaws – and while it can be adapted by a skilled teacher, it can also be harmful when used arbitrarily by an individual educator. Ultimately, letter grading promotes a counterproductive focus on obtaining the highest grades possible rather than truly learning the material. EndGradeInflation.org notes that students "must focus on higher and higher grades in order to maintain whatever level they find themselves on in respect to average...they must attempt to accumulate as many high grades as possible simply to stay ahead of the game."As a result, students concern themselves with their rank rather than on learning the material and may seek alternate ways to obtain high grades. Since "grades do not discourage academic dishonesty," students will see cheating as a viable option.

In nutshell, the traditional grading practices imposes only on Generalized Evaluation and Ranking system that often cannot be clearly explained with the high level of consistency, reliability, and clarity that should be expected of a quality educational system that is standards-based.

III. STANDARDS-BASED GRADING

It would take a dozen issues of the WORD to explain what standards-based grading is and our teachers have been studying since many years to get better at it. In the 21st Century, more and more, students will have to become self motivated to want to learn for the sake of learning. Students attitudes will change. Students cannot be motivated only because they want to get an “A.” The real world does not work that way. Teachers will change. More and more, teachers will recognize that grading by itself is not the way to

motivate students to perform well. That the best way to motivate students to perform well will be to provide interesting, engaging, challenging, and meaningful learning experiences each day. On this topic, the research is clear – when grading is clear (when students have a clear understanding of what the learning target is) and when learning in the classroom is not a mystery, then student achievement increases. The experts like Ken O’ Connor and others have written books to pull together the ideas that are now called “standards-based grading.”

Implementation of Standards-Based Grading:

CBSE CCE System EXAMINATION REFORMS AND CONTINUOUS AND COMPREHENSIVE EVALUATION (CCE)

C – Continuous C – Comprehensive

E – Evaluation Continuous stands for assessment of a student throughout the year, not just at the end of a term. It may be done formally or in an informal way using different techniques of evaluation. Comprehensive takes care of assessment of all round development of a child’s personality. A child will be assessed not only in terms of his knowledge about a subject but his participation in other activities also. Broadly, we assess a child’s growth in two areas – Scholastic and Co-scholastic. The term Scholastic refers to those aspects, which are related to intellect or the brain. It is related to the assessment of learners in curricular subjects. It includes assignments, projects, practical etc

Formative Assessment and Summative Assessments:

A school session is divided into two terms: First term – April to September. Second term – October to March. Each term has two Formative Assessments (FA) and one Summative Assessment (SA). Syllabus covered in the first term will not be included in the second term.

First Term (40%)

FA I – April to July 10%

FA 2 – July to Sept. 10%

SA I – End of Sept. 20%

Second Term (60%)

FA 3 – Oct. to Dec. 10%

FA 4 – Dec. to Feb. 10%

SA 2 – End of March 40%

FORMATIVE ASSESSMENT (FA) Formative assessment includes all types of tests, formal and informal. Assessment can be done during the teaching process or after completing a unit. It includes: Class work Quizzes Home work Worksheets Oral test Assignment Group discussion Group activity Experiments Projects Conversation/ Interview the record of FA will be maintained by the class teacher and subject teachers.

SUMMATIVE ASSESSMENT (SA) this is the most common way of testing that is paper pen test based on the curriculum taught during the specified time period. The performance of a child in scholastic area will be assessed in

terms of marks. Marks will be known to the student but his report card will show grades only.

Standards-Based Grading is Complex

The truth is that all teachers have been moving away from traditional grading and toward a more modern and better way of grading for a long, long time. The best of teachers know that it is just common sense to not let the bad things in traditional grading harm students and a positive learning process.

Sometimes the pressure of Grades is too much and it itself becomes a distraction in teaching among teachers and learning among students. This may result in risky behavior like suicidal tendencies and other disorders.

Grading system has tendency to be misused. Some schools attempt to enhance the discriminatory function of letter grades by adding pluses or minuses, or by pairing letter grades with percentage indicators.

Student's cultural differences, their appearance, family backgrounds and lifestyles can sometimes result in biased evaluations of their academic performance. Teachers' perceptions of students' behavior can also significantly influence their judgments of academic performance. Students with behavior and handwriting problems who otherwise maybe academically proficient can also affect a teachers' judgment.

Many times, students tend to withdraw from learning upon receiving low grades. And instead of prompting greater effort it prompts students to blame themselves for the low marks and a feeling of helplessness to improve prevails. In such a situation Grading becomes irrelevant and meaningless. Rather it discourages self-image.

The biggest disadvantage of the Central Board of Secondary Education Continuous Comprehensive Learningprogramme is the grading system that it uses. [Students scoring 90 marks and 99 marks respectively will still both attain an A* grade, so it could be described as unfair for the student scoring the higher mark. One other shortcoming is the fact that huge numbers of students are grouped together.

IV. SUGGESTIVE APPROACH

The whole idea behind new method of grading is to be able to provide an accurate portrayal of student performance. Certainly, there are more sides to traditional and standard-based assessment, but this is just a suggestive prototype that tries to answer the flaws of previous methods.

Suggestive prototypes:

AF : Academic factors – This includes the continuous evaluation of academic performances of the student by applying traditional system.

CF : Consistency factors- This consist of student performance such as effort, attitude, response, react, participation etc.

PF : Psychological factors – This is one that clearly communicate to identify the areas of strength and weakness of the student based on his family background, physical disability, appearance and other psychological feelings.

SF : Supportive factors –These are the other influencing factors that supports student overall personality development.

CP : Competent factors – This is a special parameter, where a system identifies the exceptional well talented students in grooming their learning process and making them competent.

We use an example to illustrate the process of the students' learning performance evaluation using

Fuzzy membership functions and fuzzy rules. Assume that there are ten students S_1, S_2, \dots, S_{10} and we need to use all the five prototype(Q_1, Q_2, Q_3, Q_4, Q_5) in their evaluation. Let the accuracy rate matrix A , the performance-rate matrix T , grade matrix G , the importance matrix IM and the complexity matrix C are as follows:

$$A = \begin{matrix} & S_1 & S_2 & S_3 & S_4 & S_5 & S_6 & S_7 & S_8 & S_9 & S_{10} \\ \begin{matrix} Q_1 \\ Q_2 \\ Q_3 \\ Q_4 \\ Q_5 \end{matrix} & \begin{bmatrix} 0.59 & 0.35 & 1 & 0.66 & 0.11 & 0.08 & 0.84 & 0.23 & 0.4 & 0.24 \\ 0.01 & 0.27 & 0.14 & 0.04 & 0.88 & 0.16 & 0.04 & 0.22 & 0.81 & 0.53 \\ 0.77 & 0.69 & 0.97 & 0.71 & 0.17 & 0.86 & 0.87 & 0.42 & 0.91 & 0.74 \\ 0.73 & 0.72 & 0.18 & 0.16 & 0.5 & 0.02 & 0.32 & 0.92 & 0.9 & 0.25 \\ 0.93 & 0.49 & 0.08 & 0.81 & 0.65 & 0.93 & 0.39 & 0.51 & 0.97 & 0.61 \end{bmatrix} \end{matrix}$$

$$T = \begin{matrix} & S_1 & S_2 & S_3 & S_4 & S_5 & S_6 & S_7 & S_8 & S_9 & S_{10} \\ \begin{matrix} Q_1 \\ Q_2 \\ Q_3 \\ Q_4 \\ Q_5 \end{matrix} & \begin{bmatrix} 0.7 & 0.4 & 0.1 & 1 & 0.7 & 0.2 & 0.7 & 0.6 & 0.4 & 0.9 \\ 1 & 0 & 0.9 & 0.3 & 1 & 0.3 & 0.2 & 0.8 & 0 & 0.3 \\ 0 & 0.1 & 0 & 0.1 & 0.9 & 1 & 0.2 & 0.3 & 0.1 & 0.4 \\ 0.2 & 0.1 & 0 & 1 & 1 & 0.3 & 0.4 & 0.8 & 0.7 & 0.5 \\ 0 & 0.1 & 1 & 1 & 0.6 & 1 & 0.8 & 0.2 & 0.8 & 0.2 \end{bmatrix} \end{matrix}$$

$$C = \begin{matrix} & CS_1 & CS_2 & CS_3 & CS_4 & CS_5 \\ \begin{matrix} Q_1 \\ Q_2 \\ Q_3 \\ Q_4 \\ Q_5 \end{matrix} & \begin{bmatrix} 0 & 0.85 & 0.15 & 0 & 0 \\ 0 & 0 & 0.33 & 0.67 & 0 \\ 0 & 0 & 0 & 0.69 & 0.31 \\ 0.56 & 0.44 & 0 & 0 & 0 \\ 0 & 0 & 0.7 & 0.3 & 0 \end{bmatrix} \end{matrix}$$

$$IM = \begin{matrix} & IMS_1 & IMS_2 & IMS_3 & IMS_4 & IMS_5 \\ \begin{matrix} Q_1 \\ Q_2 \\ Q_3 \\ Q_4 \\ Q_5 \end{matrix} & \begin{bmatrix} 0 & 0 & 0 & 0 & 1 \\ 0 & 0.33 & 0.67 & 0 & 0 \\ 0 & 0 & 0 & 0.15 & 0.85 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0.07 & 0.93 & 0 & 0 \end{bmatrix} \end{matrix}$$

Then, based on the accuracy rate matrix A, the grade matrix G, we can get the total grade of each student, where the total grades of the students S1, S2, S3, S4, S5, S6, S7, S8, S9 and S10 are 67.6, 54.05, 38.4, 49.7, 49.7, 48.8, 46.1, 52.3, 85.95 and 49.7, respectively. Because the students S4, S5 and S10 have the same total grade, they get the same ranking order (i.e., Top 5), i.e., the ranking order of these ten students is follows:

$$S9 > S1 > S2 > S8 > S4 \frac{1}{4} S5 \frac{1}{4} S10 > S6 > S7 > S3:$$

Then, we use the proposed method to deal with the ranking order of the students S4, S5 and S10, shown as follows:

[Step 1] Based on the accuracy rate matrix A, the consistency factors are determined with the Performance – rate matrix T and obtain the average accuracy rate as follows:

$$adv_i = \frac{0.1 \times v_{i1} + 0.3 \times v_{i2} + 0.5 \times v_{i3} + 0.7 \times v_{i4} + 0.9 \times v_{i5}}{0.1 + 0.3 + 0.5 + 0.7 + 0.9},$$

$$FA = \begin{matrix} & FAS_1 & FAS_2 & FAS_3 & FAS_4 & FAS_5 \\ \begin{matrix} Q_1 \\ Q_2 \\ Q_3 \\ Q_4 \\ Q_5 \end{matrix} & \begin{bmatrix} 0 & 0.25 & 0.75 & 0 & 0 \\ 0 & 0.95 & 0.05 & 0 & 0 \\ 0 & 0 & 0 & 0.945 & 0.055 \\ 0 & 0.15 & 0.85 & 0 & 0 \\ 0 & 0 & 0.315 & 0.685 & 0 \end{bmatrix} \end{matrix},$$

$$FT = \begin{matrix} & FTS_1 & FTS_2 & FTS_3 & FTS_4 & FTS_5 \\ \begin{matrix} Q_1 \\ Q_2 \\ Q_3 \\ Q_4 \\ Q_5 \end{matrix} & \begin{bmatrix} 0 & 0 & 0.65 & 0.35 & 0 \\ 0 & 0.1 & 0.9 & 0 & 0 \\ 0 & 0.95 & 0.05 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0.65 & 0.35 & 0 \end{bmatrix} \end{matrix}.$$

Then, after fuzzifying these values, we can get the fuzzy grade matrix FA, Fuzzy performance as shown above:

[Step 2] Based on FA and FT, we can perform fuzzy reasoning to evaluate the difficulty in evaluation process. Then, we can get the difficulty matrix D.

$$D = \begin{matrix} & DS_1 & DS_2 & DS_3 & DS_4 & DS_5 \\ \begin{matrix} Q_1 \\ Q_2 \\ Q_3 \\ Q_4 \\ Q_5 \end{matrix} & \begin{bmatrix} 0 & 0.45 & 0.71 & 0.59 & 0.15 \\ 0.4 & 0.57 & 0.61 & 0.93 & 0.57 \\ 0.57 & 0.95 & 0.57 & 0.57 & 0 \\ 0 & 0.51 & 0.91 & 0.51 & 0.09 \\ 0.41 & 0.67 & 0.55 & 0.41 & 0.14 \end{bmatrix} \end{matrix}.$$

[Step 3] Based on the difficulty matrix D and the complexity matrix C, the fuzzy rule matrix can get the evaluation metric, as shown:

$$CO = \begin{matrix} & CoS_1 & CoS_2 & CoS_3 & CoS_4 & CoS_5 \\ \begin{matrix} Q_1 \\ Q_2 \\ Q_3 \\ Q_4 \\ Q_5 \end{matrix} & \begin{bmatrix} 0.32 & 0.75 & 0.67 & 0.5 & 0.41 \\ 0.4 & 0.65 & 0.65 & 0.85 & 0.65 \\ 0.66 & 0.66 & 0.87 & 0.76 & 0.49 \\ 0.53 & 0.81 & 0.77 & 0.64 & 0.36 \\ 0.47 & 0.68 & 0.60 & 0.50 & 0.29 \end{bmatrix} \end{matrix}.$$

[Step 4] Based on the CO and the importance matrix IM, the fuzzy rule, we can perform fuzzy reasoning to evaluate the adjustment value for each prototype. Then, we can get the adjustment matrix V, as shown.

$$V = \begin{matrix} & VS_1 & VS_2 & VS_3 & VS_4 & VS_5 \\ \begin{matrix} Q_1 \\ Q_2 \\ Q_3 \\ Q_4 \\ Q_5 \end{matrix} & \begin{bmatrix} 0.38 & 0.38 & 0.66 & 0.88 & 0.75 \\ 0.36 & 0.66 & 0.66 & 0.76 & 0.43 \\ 0.33 & 0.43 & 0.76 & 0.86 & 0.80 \\ 0.90 & 0.88 & 0.68 & 0.40 & 0.32 \\ 0.34 & 0.80 & 0.76 & 0.71 & 0.25 \end{bmatrix} \end{matrix}.$$

[Step 5] Because there are 3 students with the same total grade, we construct a new grade matrix EA for the equal grade students S4, S5 and S10.

$$EA = \begin{matrix} & ES_1 & ES_2 & ES_3 \\ \begin{matrix} Q_1 \\ Q_2 \\ Q_3 \\ Q_4 \\ Q_5 \end{matrix} & \begin{bmatrix} 0.66 & 0.11 & 0.24 \\ 0.04 & 0.88 & 0.53 \\ 0.71 & 0.17 & 0.74 \\ 0.16 & 0.5 & 0.25 \\ 0.81 & 0.65 & 0.61 \end{bmatrix} \end{matrix}.$$

[Step 6] Based on the final adjustment values and averages of five suggestive prototype we can calculate sum of differences for each students in the order of SOD1= 3.15,

$$SOD2 = 5.3, SOD3 = 2.15 \text{ for the students } S4, S5 \text{ and } S10.$$

We can see that the ranking order of the Students S4, S5 and S10 is: S4 > S10 > S5. That is, the students S4, S10 and S5 are the Top 5, the Top 6 and the Top 7, respectively. Therefore, the ranking order of these ten students becomes:

$$S9 > S1 > S2 > S8 > S4 > S10 > S5 > S6 > S7 > S3.$$

Thus new method of grading is able to provide an accurate portrait of student's performance.

V. CONCLUSION

In this paper, we have presented a new method to deal with the learning achievement evaluation using fuzzy membership functions and fuzzy rules. The proposed method considers the difficulty, importance and complexity of questions for students' answer script evaluation. It provides a useful way to distinguish the ranking order of students with the same score.

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