

Research Papers/Extended Abstracts

Scaling of Assessment Marks: A Case in the Faculty of Science, Eastern University, Sri Lanka

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Abstract

Scaling of marks or standardizing is a moderation process for the assessment marks to make a decision about the boundary points between the students' marks and the grades on a course. Scaling for assessment marks is done for the entire students of each course offered by the faculty. Scaling is not used to adjust for an individual student's marks, and the scaling is not used to adjust the final mark at the programme level when awarding a degree for the programme. In other words, scaling is used only to change the grade that contributes to the overall grade point average for the entire students for a particular course. In this study, the scaling methodology adopted by the Faculty of Science, Eastern University, Sri Lanka to assign letter grades for the raw marks obtained by the undergraduates for all the general degree courses was considered. The faculty prepared this scale grading table by reducing two or three marks from the minimum marks for each grade and then maintaining similar intervals in the original table. There were four different columns (tables) for the scaling of marks. Based on the average marks of a particular course, the appropriate column was selected and the grades were assigned. By applying the scale grading table, when the average marks were very low, the lower letter grades were improved to better letter grades while when the class average was high, there were no significant changes occurred in the letter grades awarded.

Keywords: *Assessment Marks, Class Average, Letter Grades, Scale Grading Table*

Introduction

Scaling of marks is the systematic adjustment of marks for an entire cohort of students for a course/module in order to ensure the final marks better reflect the achievement of the students. Scaling is in practice in many universities in many countries. The universities published the policies of scaling in their university webpages for the students and the general public. The Oxford University allows the scaling of marks on a paper is only appropriate when the examiners can supply evidence for at least one of the following scenarios (University of Oxford, 2023).

- a. A paper was more/less difficult than in previous years
- b. An optional paper was more/less difficult than other optional papers taken by students in a particular year
- c. A paper has generated a spread of marks which is not a fair reflection of student performance on the University's standard scale for the expression of agreed final marks.

The Oxford University uses the following algorithm methods for scaling:

- Simple addition – a fixed number of marks is added to either (i) a particular assessment component of a script, or (ii) the final script mark, as long as no scaled marks are then greater than the total marks available for the script.
- Simple subtraction – a fixed number of marks are subtracted to either (i) a particular assessment component of a script, or (ii) the final script mark, as long as no scaled marks are less than 0.
- Multiplication by a factor – all marks on a script are multiplied by a particular factor (for example 0.96).

The decision to adjust marks using scaling is made by a Board of Examiners for Units (BEU) after considering specific statistical data. If the marks count towards a classification, the external examiner (an academic from a similar department at another UK university) must be consulted and their views are considered by the BEU (University of Bath, 2024). In Cardiff University, the decision to adjust marks using scaling is made by an Examining Board exercising its collective academic judgment after considering specific statistical data. The Policy is very clear that it should not be used to change the marks to achieve an 'ideal' distribution of results. The scaling is used to either increase a spread of students across the mark range or to re-align a high or low average attainment (Cardiff University, 2023). This university follows some simple scaling methods mentioned below.

- Addition of marks – an agreed percentage is added to each mark.
- Multiplication by a factor – each mark is multiplied by an agreed factor.

Further to the above simple methods, the university follows some other methods of scaling are given in their scaling policy.

In the University of Edinburgh, the Board of Examiners advises the correct method to use for the scaling. For that purpose, this university follows the following methods (University of Edinburgh, 2024):

- Angoff Linear Interpolation Method: in this method, the minimum pass mark value and the excellent mark value are changed. For example, for an undergraduate course, the University fixed the minimum pass mark value as 40 and the excellent mark value as 70. The scaling process will decide the new values, for example, as 35 and 65. The students' marks adjusted accordingly.
- Percentage Adjustment: This method is used to adjust marks within a mark range by a percentage, either positive or negative, in order for the marks to be scaled up or down.
- Linear Adjustment: This method will adjust marks within a range by a specified number, either positive or negative, in order for the marks to be scaled up or down.

The University of Southampton's scaling policy (University of Southampton, 2023) stated the time for the scaling. This stated that a discussion of whether or not to undertake scaling will often occur before Pre-Boards meet, recommendations to scale and a discussion of the rationale for scaling will be made by Pre-Boards. Scaling decisions must be confirmed by the relevant Boards of Examiners. The minutes of the Board of Examiners must include a written explanation of the reasons for scaling and the mechanisms used to undertake scaling. The university accepted the following scaling practices:

- Add a fixed number (for instance 3) of marks to all marks on a particular assessment component, as long as no scaled marks are then greater than 100;
- Subtract a fixed number (for instance 5) of marks from all marks on a particular assessment component, as long as no scaling marks are then less than 0;
- Multiply all marks on a particular assessment component by a particular factor (for example 0.96).

In the literature, the comparison and scaling of student assessments for several subjects was studied by Manly, (2018) and proposed the average marks to be used to grade the students. This paper proposed a method of comparing subjects based on cumulative sums of differences between subject marks and student mean marks.

McLachlan, & Susan, (2001) considered the methods of aggregation. They suggested that the arithmetic means should not be calculated during aggregation and the ways of converting scores to grades were discussed. They suggested that the median should be calculated as the measure of overall performance, not the arithmetic mean (McLachlan, & Susan, 2001).

A study of the influence of the system called 'SCALING' used in Anglo-Saxon universities done by Aunon et.al (2020) on the marks of the students in engineering school. On some occasions, procedures for conditioning the initial marks obtained by a student group in a first phase of evaluation process must be modified up or down. The SCALING system is the official modification of the students' marks in the different groups, subjects, courses depending where it is applied. This modification is done through statistical adjustments, mathematical models or other criteria. Scaling of marks is studied and some methodologies of scaling are presented in the previous publications (Adams, & Wilmot, 1981; Bose & Choudhury, 1955; Daley, & Seneta, 1986; Daley, 1995; Gunawardana et al., 2022).

This study assessed the implementation of the scaling process at the Faculty of Science, Eastern University, Sri Lanka. The faculty observed that the academic performance of the general degree under graduates of the Faculty was very low and many students struggled to complete their degree programme on time. In addition, the academic performance of the first year students was very much lower than the expected grades. Considering this situation, the faculty introduced a scaling method for all the general degree courses. It prepared a table with four columns with the raw marks mapped to letter grades. The appropriate column for each course was selected based on the average marks of the students who sat for the particular course. This study considered one first year course offered to three different batches and analyzed the changes in the letter grades assigned to the students.

Methodology

Algebra is a two credit course taught at the first year, first semester for the physical science students at the faculty. The raw marks of the first year, first end semester examinations for the three different batches of the students were considered. The faculty initially used Table 1 as the grading table for assigning the letter grades against the raw marks and considered it as the original grading table.

Table 1: Original grading table

Marks	Grade	Marks	Grade
≥ 75	A+	45 - 49	C+
70 – 74	A	40 - 44	C
65 - 69	A-	35 - 39	C-
60 - 64	B+	30 - 34	D+
55 - 59	B	25 - 29	D
50 - 54	B-	≤ 24	E

To avoid the higher failure rate in the end semester examinations, the faculty introduced a scaling method to upgrade the failing grades. For this purpose, the faculty prepared a grading table with four column of raw marks with the assignment of letter grades. Based on the average marks of the class in the end semester examination raw marks, the appropriate column is selected and assigned the relevant letter grades. The scale grading table used by the faculty at present is given in Table 2. The faculty prepared this scale grading table by reducing two or three marks from the minimum marks for each grade and then maintaining similar intervals in the original table.

Table 2: Scale grading table

Grade and Grade Points		Average Marks of the Class			
		60 – 100	55 - 59	50 - 54	35 - 49
		Marks Ranges to be mapped			
A+	4.00	80 – 100	80 - 100	80 - 100	80 - 100
A	4.00	75 – 79	74 - 79	73 - 79	71 - 79
A-	3.70	70 – 74	68 - 73	65 - 72	64 - 70
B+	3.30	65 – 69	61 - 67	58 - 64	57 - 63
B	3.00	60 – 64	55 - 60	50 - 57	49 - 56
B-	2.70	55 – 59	50 - 54	46 - 49	45 - 48
C+	2.30	50 – 54	46 - 49	42 - 45	40 - 44
C	2.00	45 – 49	41 - 45	38 - 41	37 - 39
C-	1.70	40 – 44	37 - 40	33 - 37	32 - 36
D+	1.30	35 – 39	32 - 36	29 - 32	28 - 31
D	1.00	25 – 34	23 - 31	21 - 28	20 - 27
E	0.00	00 – 24	00 - 22	00 - 20	00 - 19

The raw marks for the first year, first semester course on Algebra were analyzed considering three batches of students: 2018/2019, 2019/2020, and 2016/2017. The class average of the first two batches was low while the class average for the 2016/2017 batch was high. Initially, letter grades were

assigned to each student's raw marks using the original grading table. Subsequently, letter grades for each batch were assigned based on the scale grading table currently in use for the grade assignments.

Results

The letter grades for the raw marks of the 2018/2019 batch were assigned using both tables. Since their class average was in the range of 35-49, the last column of the scale grading table was used to assign the letter grades. The distribution of assigned letter grades for 2018/2019 batch using both grading tables is illustrated in the Figure 1.



Figure 1: Distribution of grades for the intake batch 2018/2019.

There was a decrease in the number of letter grades at “C”/below when the scale grading table was used while there was an increase in the number of letter grades at “C”/above.

Since the letter grade C has a GPA value of 2.0 and the minimum GPA required for the award of a degree is 2.00, a student should obtain an average of C grade in all the courses. Considering this fact, the letter grade C was considered as the passing grade in this analysis. When the original grading table was used, 30.34% of students obtained the letter grades below the C, while it was reduced to 22.78% when the scale grading table was used.

Next, the raw marks for the 2019/2020 batch of students were considered. Their average marks have fallen in the range of the last column of the scale grading table. The letter grades for this set of raw marks were awarded using both the original grading table and the scale grading table and presented their letter grade distribution in the Figure 2.



Figure 2: Distribution of grades for the intake batch 2019/2020.

Similar to the above, there was a decrease in the number of letter grades at “C”/ below when the scale grading table was used except a slight increase in the C- grade. Further, there was an increase in the number of letter grades at “C”/above except the letter grades A+ and B-. Further, when the original grading table was used, 33.93% of students obtained the letter grades below the C and it was reduced to 28.57% when the scale grading table was used.

Finally, the raw marks of the 2016/2017 batch were considered and its class average was higher than the other two batches. The class average for this batch has fallen in the range 55-59 and the second column of the scale grading table was used to award the letter grades. The grades assigned according to both the original grading table and the scale grading table were presented in Figure 03.

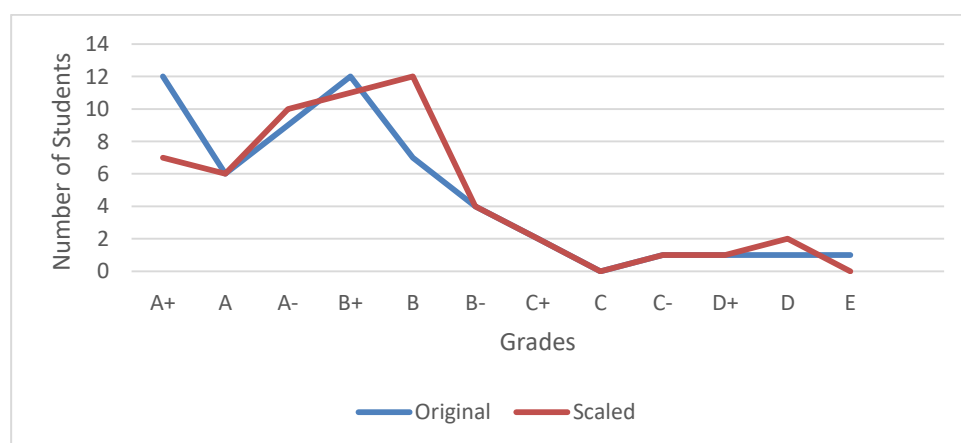


Figure 3: Distribution of grades for the intake batch 2016/2017.

There was a decrease in the number of letter grades below the C grade except for the D grade. In addition, there was an increase in the number of letter grades above the C grade except for the grades A+ and B+. Further, there was no change in the percentage of students obtaining the letter grades below the C grade which is equal to 7.14%.

Conclusion

When the class average of raw marks is very low, the scale grading method decreases the number of letter grades below C while increases the number of letter grades above C. In contrast, when the class average is high, applying the scale grading method does not significantly alter the letter grades obtained by the students. Therefore, it is recommended to apply the scale grading method only when the class average is low.

References

- Adams, R. M., & Wilmut, J. (1981). A measure of the weights of examination components, and scaling to adjust them. *Journal of the Royal Statistical Society: Series D (The Statistician)*, 30(4), 263–269.
- Auñón, J. A., Merino, S., Maldonado, D. J., García-Sánchez, F., Sevilla, L., Castillo, G., & González, M. (2020). Scaling system implementation study of the students marks in Spanish engineering studies. *EDULEARN20 Proceedings*, IATED. 517–524.
- Bose, P. K., & Choudhury, S. B. (1955). Scaling procedures in scholastic and vocational tests. *Sankhyā: The Indian Journal of Statistics (1933–1960)*, 15(1/2), 197–206.
- Cardiff University. (2023). Scaling of marks. Retrieved from <https://www.cardiffstudents.com/advice/academic/scaling/>
- Daley, D. J. (1995). Two-moment scaling formulae for aggregating examination marks. *Australian Journal of Statistics*, 37(3), 253–272.
- Gunawardana, K. G. S. H., et al. (2002). Scaling marks distribution of underperformed assessments to avoid higher failure rates. *Proceedings of the Ruhuna Quality Assurance Sessions 2022 (RUQAS 2022)*, University of Ruhuna, Sri Lanka, 36–42.
- Manly, B. F. (1988). The comparison and scaling of student assessment marks in several subjects. *Journal of the Royal Statistical Society Series C: Applied Statistics*, 37(3), 385–395.
- McLachlan, J. C., & Whiten, S. C. (2000). Marks, scores and grades: Scaling and aggregating student assessment outcomes. *Medical Education*, 34(10), 788–797.
- University of Bath. (2024). Scaling unit marks. <https://www.bath.ac.uk/legal-information/scaling-unit-marks/>

University of Edinburgh. (2024). *How to scale marks*. <https://www.ed.ac.uk/student-systems/support-guidance/professional-services/student-admin-colleges-schools/assessment-hub/scaling-marks/how-to-scale-marks>

University of Oxford. (2023). *Supplementary advice regarding scaling of marks*. <https://academic.web.ox.ac.uk/files/supplementaryadviceregardingscalingofmarkspdf>

University of Southampton. (2023). *Scaling policy*. [https://www.southampton.ac.uk/~ assets/doc/quality-handbook/Scaling%20Policy.pdf](https://www.southampton.ac.uk/~assets/doc/quality-handbook/Scaling%20Policy.pdf)