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A comparative study of grades assigned between the Five- and Eight- Category Grading Systems

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The objective of this study was to compare the grades point average of students when determined by the five-category grading system (A, B, C, D, F) and the eight-category grading system (A, B+, B, C+, C, D+, D, F). The population comprised 149 second year medical students, Faculty of Medicine, Chulalongkorn University, first semester in academic year 1993. After this final examination, the scores of the students were calculated by the five-category grading system and the eight-category grading system. The examination covered seven subjects: Gross Anatomy 1, Gross Anatomy 2, Histology 1, Human Genetics, Biochemistry, Basic Psychiatry and Physiology 1. The reliability indices of the examination were 0.888, 0.841, 0.874, 0.841, 0.914, 0.706 and 0.850, respectively. The grade point averages (GPAs) of the students were calculated and tested for significance by student's t-test, the students were divided into three groups: those who received a GPA equal to 3.00 and over; those who received a GPA equal to 2.00 to 2.99; and those who received a GPA equal to 1.99 or lower. The results were as follows:-

1. When comparing between the five-category and the eight-category grading system, all students had GPA not significantly different.

2. At GPA equal 3.00 and over, the five-category grading system gave the number of students more than the eight-category grading system significantly different at level 0.01 ($p < 0.01$).

3. At GPA less than 3.00, the eight-category grading system gave the number of students more than the five-category grading system significantly different at level 0.01 ($p < 0.01$).

The five-category grading system should be appropriate for the educational institutions where had the exceptional, superior and good students ($GPA \geq 2.40$). The eight-category grading system should be appropriate for the educational institutions where had the fair, average, weak and poor students ($GPA \leq 2.20$).

Key words: *Grade, Grading System, Grade Point Average, Reliability, Medical Education, Mark.*

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บุญนาท ลายสนิทเสรีกุล. การเปรียบเทียบการให้เกรดระหว่างระบบการให้เกรดชนิด 5 ตัวอักษรและ 8 ตัวอักษร. จุฬาลงกรณ์เวชสาร 2537. ตุลาคม; 38(10): 579-588

การศึกษานี้มีวัตถุประสงค์เพื่อเปรียบเทียบอันดับคะแนนเฉลี่ยที่ได้จากระบบการให้เกรดชนิด 5 ตัวอักษร (A, B, C, D, F) กับระบบการให้เกรดชนิด 8 ตัวอักษร (A, B+, B, C+, C, D+, D, F) กลุ่มประชากรที่ศึกษาคือ นิสิตแพทย์ชั้นปีที่ 2 คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ภาคเรียนที่ 1 ปีการศึกษา 2536 จำนวน 149 คน นำคะแนนสอบไล่จาก 7 รายวิชามาให้เกรดด้วยระบบการให้เกรดชนิด 5 ตัวอักษรและชนิด 8 ตัวอักษร รายวิชาทั้ง 7 รายวิชา ได้แก่ มหกายวิภาคศาสตร์ 1 มหกายวิภาคศาสตร์ 2 วิทยาฮิสโต 1 มนุษย์พันธุศาสตร์ ชีวเคมี จิตเวชพื้นฐาน และสรีรวิทยา 1 ซึ่งคำนวณค่าความเที่ยงเท่ากับ 0.888, 0.841, 0.874, 0.841, 0.914, 0.706 และ 0.850 ตามลำดับ คำนวณหาค่าอันดับคะแนนเฉลี่ยและเปรียบเทียบระหว่างอันดับคะแนนเฉลี่ยจากระบบการให้เกรดชนิด 5 ตัวอักษร และชนิด 8 ตัวอักษรของนิสิตแพทย์ทั้งหมด, นิสิตแพทย์ที่ได้อันดับคะแนนเฉลี่ยตั้งแต่ 3.00 ขึ้นไป, นิสิตแพทย์ที่ได้อันดับคะแนนเฉลี่ยระหว่าง 2.00 ถึง 2.99, และนิสิตแพทย์ที่ได้อันดับคะแนนเฉลี่ยตั้งแต่ 1.99 ลงมา ผลการศึกษามีดังนี้

1. เมื่อเปรียบเทียบอันดับคะแนนเฉลี่ย ที่ได้จากระบบการให้เกรดชนิด 5 ตัวอักษรและชนิด 8 ตัวอักษร ของนิสิตแพทย์ทั้งหมด พบว่าไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ
2. เมื่อพิจารณาที่อันดับคะแนนเฉลี่ยตั้งแต่ 3.00 ขึ้นไป พบว่าระบบการให้เกรดชนิด 5 ตัวอักษร ทำให้ได้จำนวนนิสิตมากกว่าระบบการให้เกรดชนิด 8 ตัวอักษร อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.01 ($p < .01$).
3. เมื่อพิจารณาที่อันดับคะแนนเฉลี่ยน้อยกว่า 3.00 พบว่าระบบการให้เกรดชนิด 8 ตัวอักษร ทำให้ได้จำนวนนิสิตมากกว่าระบบการให้เกรดชนิด 5 ตัวอักษร อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.01 ($p < .01$).

ระบบการให้เกรดชนิด 5 ตัวอักษรมีความเหมาะสมกับสถานศึกษาที่มีผู้เรียนที่มีระดับความสามารถเฉลี่ยอยู่ในกลุ่มดีเลิศ ดีมาก และดี (อันดับคะแนนเฉลี่ยมากกว่าหรือเท่ากับ 2.40) ส่วนระบบการให้เกรดชนิด 8 ตัวอักษรมีความเหมาะสมกับสถานศึกษา ที่มีผู้เรียนที่มีระดับความสามารถเฉลี่ยอยู่ในกลุ่มพอใช้ ปานกลาง อ่อน และอ่อนมาก (อันดับคะแนนเฉลี่ยเท่ากับหรือน้อยกว่า 2.20)

Grading systems are deeply embedded in the educational culture of a society and serve a number of legitimate educational ends. For these reasons, they are likely to survive for some time to come. Among the purposes served by a grading system with at least a minimal level of success are (1) informing parents about how their child is perceived by the school or she is attending; (2) helping to form the student's picture of himself or herself as a learner and helping the student to set goals for further levels of learning, (3) regulating the flow of students into specific programs and activities within an educational institution, and (4) regulating admission to more advanced educational institutions and the world of work.⁽¹⁾

The traditional method of reporting a pupil's progress, which is still in wide use today, consists of assigning a single letter grade (e.g. A, B, C, D, F) or a single number (e.g. 5, 4, 3, 2, 1) to represent the pupil's achievement in each subject or behavior category. This system is concise and convenient, but it has several notable shortcomings: (1) The meaning of such marks is often unclear because they are a conglomerate of such diverse factors as achievement, effort, and good behavior. (2) Even where it is possible to limit the mark to academic achievement only, interpretation is difficult. A mark of C may mean average work in all areas, or high performance in some areas and low performance in others. An overall summary appraisal in the form of a single mark tells us nothing about the pupil's relative success in achieving various course objectives. (3) As typically used, letter grades have resulted in an undesirable emphasis on marks as ends in themselves. Many pupils and parents view them as goals to be achieved, rather than as a means for understanding and improving student learning. While this is not entirely the fault of the marking system, the lack of information provided by a single letter grade probably contributes to this misuse.⁽²⁾

The most common marking system in American schools utilizes 5 categories (A, B, C, D, F), which are expanded to 13 categories if +'s and -'s are used (plus and minus are not used with the grade F which signified "failure"). Some educators favor the two-category pass-fail (P-F) system -that is, a credit-no-credit system. Princeton students reported that they tended to study less and

learn less in P-F courses than they did in conventionally evaluated courses;⁽³⁾ the results of studies undertaken at other institutions have been similar.^(4,5) Ebel⁽⁶⁾ showed that, even when the composite on which the marking was based had a reliability of .95, the reliability of the resulting marks using a two-category system would be only .63. If 5 categories were used, the reliability of the corresponding marks would be .85; if 15 categories (say. A, B, C, D, F, with +'s and -'s) were used, the reliability would be .94. It is unlikely that a widespread move away from the five-category system will occur in the near future, even though the reliability of the marks could be increased with more categories.

In Thailand, the letter marks are usually used in academic institutions. Both the Faculty of Medicine, Mahidol University⁽⁷⁾ and the Faculty of Medicine, Thammasart University⁽⁸⁾ use eight categories (i.e. A, B+, B, C+, C, D+, D, F) in the grading systems while the Faculty of Medicine, Chulalongkorn University^(9,10) uses five categories (i.e. A, B, C, D, F). How different would a student's grade and GPA be if his scores were calculated by the five- or eight-category grading systems? If they are different, what grading system should be appropriate for medical students? A review of the literature from JDEX 1962-1989⁽¹¹⁾ and Thai journals from 1990 to 1993 shown that no paper studied the GPA difference among grading system. This stimulated the author's interest in studying the difference in GPA between the two aforementioned grading systems.

Objectives

1. To determine the reliability of various tests (e.g. Gross Anatomy 1, Gross Anatomy 2, Histology 1, Human Genetics, Biochemistry, Basic Psychiatry, and Physiology 1).
2. To calculate the grade and GPA from the scores of tests by the five- and the eight-category grading systems.
3. To compare the difference in GPA between the above-mentioned grading systems.
4. To suggest the grading system which may be appropriate for the medical students at Faculty of Medicine, Chulalongkorn University.

Definitions

1. The five-category grading system⁽⁹⁾

Letter Grade	Meaning	Numerical	% of grade ⁽¹⁶⁾
A	Very good	4	7
B	Good	3	24
C	Fair	2	38
D	Poor	1	24
F	Fail	0	7

2. The eight-category grading system⁽⁷⁾

Letter Grade	Meaning	Numerical	% of grade ⁽¹⁷⁾
A	Very good	4	0.13
B+	Lower very good	3.5	2.14
B	Good	3	13.59
C+	Lower good	2.5	34.13
C	Fair	2	34.13
D+	Lower fair	1.5	13.59
D	Poor	1	2.14
F	Fail	0	0.13

3. Grade Point Average (GPA)⁽¹¹⁾ The GPA represents the summation of the value of the letter grade which the student received multiplied by the weight of credits, divided by the total credits.

Example

Student No.	Gross 1	Gross 2	Histo1	Genetic	Biochem	Psy	Physio	Total
1	A	B	A	A	A	B	B	19

$$\begin{aligned}
 \text{GPA} &= \frac{\Sigma[(A \times 4) + (B \times 4) + (A \times 2) + (A \times 1) + (A \times 4) + (B \times 1) + (B \times 3)]}{19} \\
 &= \frac{\Sigma[(4 \times 4) + (3 \times 4) + (4 \times 2) + (4 \times 1) + (4 \times 4) + (3 \times 1) + (3 \times 3)]}{19} \\
 &= \frac{68}{19}
 \end{aligned}$$

$$\text{GPA} = 3.579$$

4. Norm-Referenced Grading⁽¹²⁾ The assignment of norm-referenced grades is essentially a matter of ranking the students in order of overall achievement and assigning letter grades on the basis of each student's rank in the group. Before letter grades can be assigned, a decision must be made concerning the proportion of A's, B's, C's, D's, and F's to be used. One method which was widely used, is that of assigning grades on the basis of the normal curve. It should be noted that grading on the normal curve results in an equal percentage of A's and F's, and of B's and D's. Thus, regardless of the level of ability of a group of students, the proportion of high grades is balanced by an equal proportion of low grades.

Materials and Methods

1. **Population:** The population comprised 149 second year medical students attending the Faculty of Medicine, Chulalongkorn University during academic year 1993.

2. **Instruments:** The instruments were MCQ tests of seven subjects which were used in the first semester of academic year 1993. The tests were Gross Anatomy 1 (100 questions), Gross Anatomy 2 (82 questions), Histology1 (99 questions), Human Genetics (66 questions), Biochemistry (112 questions), Basic Psychiatry (75 questions), and Physiology 1 (100 questions), credits for which subjects were, respectively, 4, 4, 2, 1,

4, 1, and 3, for a total of 19 credits.

3. Methods

3.1 Collect the students' scores in the seven subjects.

3.2 Use the LOTUS 123 program to make calculations assigning both five- and eight-category grades on a norm-referenced basis which involves comparing for all students a student's performance with that of his own classmates.

3.3 Calculate the 149 students' GPA using LOTUS 123 software.

3.4 Compare the students' GPAs obtained under the five-category grading system and the eight-category grading system. Using the EPISTAT program, the paired t-test, compare the mean of the GPAs for all the medical students; the student group who received a GPA equal to 3.00 or higher; the student group who received a GPA equal to 2.00 to 2.99; and the student group who received a GPA equal to 1.99 or lower.

Results

1. The reliability of the seven subjects MCQ tests (namely, Gross Anatomy 1, Gross Anatomy 2, Histology 1, Human Genetics, Biochemistry, Basic Psychiatry, and Physiology 1) were 0.888, 0.841, 0.874, 0.841, 0.914, 0.706, and 0.850, respectively. [Table 1]

Table 1. Reliability and others information of the seven subjects.

Subject	No. of credit	No. of question	Reliability
461201 Gross Anatomy 1	4	100	0.888
461202 Gross Anatomy 2	4	82	0.841
461204 Histology 1	2	99	0.874
461207 Human Genetics	1	66	0.841
465201 Biochemistry	4	112	0.914
467201 Basic Psychiatry	1	75	0.706
477201 Physiology 1	3	100	0.850
Total	19		

2. After assigning letter grades on the basis of the normal curve, calculating GPAs and other statistical indices, the means of the GPAs were 2.499 (five-category grade) and 2.523 (eight-category grade); standard deviations 0.557 and 0.489, respectively. The maximum scores were

3.579 (five-category grade) and 3.395 (eight-category grade), with minimum scores being 1.105 and 1.368, respectively. [Table 2] When the means of GPAs obtained under the two systems were compared, they were not significantly different. [Table 3]

Table 2. The grade assigning and GPAs of the 149 second year medical students in seven subjects.

Student Number	Grade	Gross1 4	Gross2 4	Histo1 2	Human 1	Biochem 4	Basic 1	Physio 3	GPA
1	Five	A	B	A	A	A	B	B	3.579
	Eight	B+	B	B+	B+	B+	B	B	3.289
2	Five	B	B	A	B	A	B	A	3.474
	Eight	B+	B	B+	B	B+	B	B+	3.342
3	Five	A	B	B	B	A	B	B	3.421
	Eight	B+	B	B	B	B+	B	B	3.211
4	Five	B	A	B	B	A	B	B	3.421
	Eight	B+	B+	B	B	B+	B	B	3.316
5	Five	B	B	B	B	A	B	A	3.368
	Eight	B+	B+	B	B	B+	B	B+	3.395

145	Five	D	C	D	B	D	D	D	1.316
	Eight	D	C	D+	B	D+	D	D+	1.553
146	Five	D	D	C	D	C	D	D	1.316
	Eight	D+	D	D+	D+	C	D	D	1.395
147	Five	D	D	D	C	D	C	C	1.263
	Eight	D+	D	D	C+	D+	C	D+	1.421
148	Five	D	D	D	D	C	D	D	1.211
	Eight	D	D+	D+	D	D+	D+	D+	1.368
149	Five	D	D	D	C	D	C	D	1.105
	Eight	D+	D	D	C	D+	C	D+	1.395

Table 3. The comparison of means of GPA between the five-category grading system and the eight-category grading system from 149 medical students.

Item	Five-category	Eight-category	t-test
Number of student	149	149	1.887
Mean of GPA	2.499	2.523	
S.D.	0.557	0.489	
Maximum	3.579	3.395	
Minimum	1.105	1.368	

3. By the five-category grading system, there were 46 students who received a GPA equal to 3.00 or higher. When comparing the means obtained under the two grading systems, the means of these two samples were significantly different at 0.01 ($p < .01$). This means that on average students should have a higher GPA when the five-category grading system is used. [Table 4] By the five-category grading system, there were 75 students who received a GPA equal to 2.00 to 2.99. When comparing the means obtained under both grading systems, the means of these two samples were significantly differ-

ent at 0.01 ($p < .01$), which means that on average students should have higher GPA when the eight-category grading system is used. [Table 5] By the five-category grading system, there were 28 students who a GPA was equal to 1.99 or lower. Upon comparison of the GPA means obtained under the two grading systems, the means of the two samples were significantly different at 0.01 ($p < .01$), which means that on average students should have a higher GPA when using the eight-category grading system is used. [Table 6]

Table 4. The comparison of means of GPA between the five-category grading system and the eight-category grading system from 46 medical students who received a GPA equal to 3.00 or higher.

Item	Five-category	Eight-category	t-test
Number of student	46	46	3.689*
Mean of GPA	3.130	3.056	
S.D.	0.163	0.191	
Maximum	3.579	3.395	
Minimum	3.000	2.632	

* $p < .01$

Table 5. The comparison of means of GPA between the five-category grading system and the eight-category grading system from 75 medical students who received a GPA equal to 2.00 to 2.99.

Item	Five-category	Eight-category	t-test
Number of student	75	75	2.751*
Mean of GPA	2.413	2.459	
S.D.	0.288	0.264	
Maximum	2.947	3.000	
Minimum	2.000	1.842	

* $p < .01$

Table 6. The comparison of means of GPA between the five-category grading system and the eight-category grading system from 28 medical students who received a GPA equal to 1.99 or lower.

Item	Five-category	Eight-category	t-test
Number of student	28	28	5.302*
Mean of GPA	1.692	1.819	
S.D.	0.259	0.243	
Maximum	1.947	2.184	
Minimum	1.105	1.368	

* $p < .01$

Discussion

The seven subjects MCQ tests in this experimental research study proved to be good tests because they had a reliability of 0.70 or higher.^(13,14,15) Then the error from the instruments should be control. The results of this study should indicate a real difference between the five- and the eight-category grading systems. When comparing the GPAs of the student group that received GPAs equal to 3.00 or higher, the means of these two samples were significantly different. The mean of GPAs from the five-category grading system was higher than that of the GPAs from the eight-category grading system. One reason was that the five lettermarks should represent equal intervals on the curve, giving the top 7 per cent A's, the next 24 per cent B's, the next 38 per cent C's, the next 24 per cent D's, and the next 7 per cent F's.⁽¹⁶⁾ If grades are assigned more than five letters on the normal curve, the percentage in each grade would be less than with only five grades. If eight grades are assigned the top 0.13 per cent will have A's, the next 2.14 per cent B+'s, the next 13.59 per cent B's, the next 34.13 per cent C+'s, the next 34.13 per cent C's, the next 13.59 per cent D+'s, the next 2.14 per cent D's, and the last 0.13 per cent F's.⁽¹⁷⁾ When comparing the GPAs of the student group that received GPAs equal to 2.00 to 2.99 and the student group that received GPAs equal to 1.99 or lower, the study found that the means of the GPAs from the eight-category grading system were higher than the means of the GPAs from the five-category grading system. There are two reasons for this result: 1) the percentage of students receiving grades C+ to C (68.26%) under the eight-category grading system was higher than the percentage receiving grade C (38%) under the five-category grading system, and 2) the percentage of students receiving grades D+ to D (15.73%) under

the eight-category grading system was lower than the percentage receiving grade D (24%) under the five-category grading system. From this result, Faculty of Medicine, Chulalongkorn University should still use the five-category grading system. The CU medical students usually came from the first class of high school's students. For other faculties which had the average students, they should use the eight-category grading system.

Grades are always comparative and comparisons can be made on the basis of intuition; they can be ipsative, referenced to perfection, or they can be criterion- or norm- referenced. Individuals involved in evaluating the information used to make decisions about grades need to consider what data should be taken into account in determining grades, the selection of the appropriate reference, the weighting of component data, the number of categories required, and the proportion of students that should get each grade.⁽¹⁸⁾ Marks are a means of providing feedback to students and their parents; therefore, they should be as valid and accurate as possible. The meaning of marks can be greatly improved if the basis on which they are to be assigned is clearly defined. Marks should reflect demonstrated achievement. Other important factors, such as the student's attitude, effort, and citizenship, should be evaluated and reported independently. Marks should be supplemented with written comments and other means of communication among teachers, students, and parents.⁽¹⁹⁾

Ebel⁽²⁰⁾ showed that even when the composite on which the marking was based had a reliability of .95, the reliability of the resulting marks using a two-category system would be only .63. If five categories were used, the reliability of the corresponding marks would be .85; if 15 categories (say, A, B, C, D, F, with +'s and -'s) were used, the

reliability would be .94. Jamornman⁽²¹⁾ reported that the 13 categories (namely, A+, A, A-, B+, B, B-, C+, C, C-, D+, D, D-, F) were satisfactory to instructors, students, parents and the businessmen who review grades. In the past, no one published a study on grading. However, since this research effort is the first of its type to be reported in Thailand, more research in this area would be desirable.

Summary

The objective of this experimental research study was to compare the grades of students' scores when determined by the five-category grading system (A, B, C, D, F) and the eight-category grading system (A, B+, B, C+, C, D+, D, F). The population comprised the 149 second-year medical students of the Faculty of Medicine, Chulalongkorn University first semester, academic year 1993. After their final examination, the scores of the students were determined under both of the aforementioned grading systems. Their aforementioned covered seven subjects; Gross Anatomy 1, Gross Anatomy 2, Histology 1, Human Genetics, Biochemistry, Basic Psychiatry and Physiology 1. The reliability indices of the tests were 0.888, 0.841, 0.874, 0.841, 0.914, 0.706 and 0.850, respectively. The grade point averages (GPA) of the students were calculated and tested for significance by the students' t-test. The students were classified into three categories: those receiving GPAs equal to 3.00 or over; those receiving GPAs equal to 2.00 to 2.99; and those who received GPAs equal to 1.99 or lower. The results are as follows:-

1. Comparison of the five- and eight-category grading systems showed that there were no significant difference in the GPAs of 149 second-year medical students.

2. For 46 second-year medical students who had GPAs equal to 3.00 or over, a significant difference occurred at 0.01 ($p < .01$). The GPAs of students whose grades were calculated under the five-category grading were higher than the GPAs calculated under the eight-category grading system.

3. For 75 second-year medical students who had GPAs equal to 2.00 to 2.99, a significant difference occurred at 0.01 ($p < .01$). The GPAs of students whose grades were calculated under the eight-category grading system were higher than the GPAs calculated under the five-category grading system.

4. For 28 second-year medical students who had GPAs equal to 1.99 or lower, a significant difference occurred at 0.01 ($p < .01$). The GPAs of the

students whose grades were calculated by the eight-category grading system were higher than the GPAs calculated under the five-category grading system.

The five-category grading system should be appropriate for the school where had the excellent, very good, and good student groups (GPA ≥ 2.40). The eight-category grading system should be appropriate for the school where had the fair, average, poor, and very poor student groups (GPA < 2.20).

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