

# **A comparative study on the effect of Difficulty Index and Discrimination Index in Formative Assessment (MCQs) in Technical English Course**

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## **ABSTRACT**

*This study perceived the impact of Difficulty Index and Discrimination Index in Formative Assessment (MCQs) in Technical English Course and was carried out amongst 99 first year technical students from Tamil Nadu. Moreover, it is a comparative study thus two groups were formed Group-A (54 students) and Group-B (45 students). On the whole, 30 Multiple Choice Questions (MCQs) were chosen from Technical English course for this study. The result showed that majority of the items were acceptable in discrimination index in both groups (A&B), on the other hand, difficulty index was relatively tough to group B than group A students. On the whole, difficulty and discrimination index were inevitable to validate the question papers in recent days, because it helped to identify inappropriate questions and modify poor questions.*

**Keywords:** Formative Assessment, Difficulty Index, Discrimination Index, Technical Students, Range.

## **Introduction**

In Higher Education, formative assessment is blended with the academic performance of stakeholder, moreover it is important and inevitable criterion in teaching learning process. The discrepancy between formative and summative assessment was proposed by Scriven (1967, pp. 39). According to Blooms (1969, pp.26), formative evaluation refers “to provide feedback and correctives at each stage in the teaching-learning process”. Summative assessment refers to final score or grade achieved by stakeholder at the end of the course (Bennett, 2011, pp.7). In formative assessment, the instructor gives clear solution to the problem in the form of feedback or discussion whereas, in summative assessment instructors could not provide any feedback moreover, formative and

summative assessments are customized but lies on the same pathway. Periodical feedback using formative assessment helps stakeholders to achieve further in the summative assignment. Assessment and examination are different in Indian educational structure, the understanding of assessment of learning and assessment of examination are two different aspect. Rowntree (1987) stated that summative assessment is used to assign grade at the end of the course, whereas formative assessment is used to give feedback to improve stakeholders plodding performance of the entire course, so it is very necessary to do formative assessment. The instructors should understand the formative assessments clearly, thus it is helping stakeholders to learn effectively. Kumar et al., (2021) noticed that item analysis (difficulty and discrimination index) must be

carried out for the betterment assessment. Similarly, Harti et al., (2021) concerned that formative assessment should not be dealt with the conventional method. Eventually, assessment techniques are very important in the contemporary educational milieu.

The primary function of formative assessment is to help students to develop as an effective learners in the specific domain. According to Carnoy and Loeb (2004, pp.305), “testing is one component of a broader and deeper set of sustained changes necessary for education improvement to occur, gauge to increase standards, to assess curricula or to provide technical assistance (p. 192)”. Cliff et al., (2008, pp.337) clarified that students who did not undergo formative assessment have secured low grade in summative assessment. In addition, Aravinthan and Aravinthan (2010) stated that overall grade of the students were increased when they have completed their formative assessment. Similarly, Furthermore, Stull et al., (2011, pp.30) described that there was a significant impact found between the formative assessment and students’ performance. Knight and Yorke (2003) urged that summative assessment could not strengthen learners’ conceptual knowledge and career guidance. Furthermore, Mentkowski and Associates (2000) carried out a study on impact of formative assessment and result showed that it improves learners’ metacognitive level through self-regulation. Pande et al., (2013, pp.45) carried out a study on difficulty and discrimination index in Psychology amongst 100 respondents using 240 MCQs. The result showed that most of the items were accepted in difficulty and discrimination index. However, the easiest and difficult items were contributing poor discrimination index.

Mahjabeen (2017, pp.13) carried out a cross-

sectional study in Pathology using 65 MCQs to identify the quality of MCQs difficulty and discrimination index. The result showed that 80% of items were acceptable level of difficulty and discrimination index. In addition, Hingorjo and Jaleel (2012, pp.142) investigated the difficulty and discrimination index in Physiology paper among 102 first year dental students using 50 MCQs. The result revealed that half of the items were accepted and out layers were rejected. Hotiu (2016) conducted a study on correlation between difficulty and discrimination index of 60 MCQs in Physical science paper and the result exposed that increase in difficulty index, increase in discrimination index. Ho et al., (2021) reinforced that item analysis helped to identify the questions stability and validation. In addition, Reza et al., (2021) suggested that item analysis enhanced higher order thinking questions. Form the light of the literature review, discrimination and difficulty index are very important elements in validate the formative question papers irrespective of all branches. It paves a way to identify the knowledge gap, no studies were carried out on difficulty index and discrimination index on technical English course especially on formative assessment in Indian context.

### **Research Questions**

1. What is the impact of Difficulty and Discrimination index in formative assessment between groups?
2. What is the cause of Difficulty index and Discrimination index in formative assessment?
3. How does the formative assessment influence teaching and learning process?

### **Methodology**

#### **Participants**

Convenient sampling technique was adopted for

this study, furthermore, 99 (Group A=54 & Group B=45) first year technical students were involved in this study. Thirty multiple choice questions (MCQs) were framed from technical English subject.

### Data Collection and Analysis

The data were collected and decoded the value 1 (one) for correct answers and 0 (zero) for wrong answers. The data were published in 'Mendeley Data Repository' - <https://data.mendeley.com/datasets/fv2k8pmbhw> (DOI: 10.17632/fv2k8pmbhw.1). The difficulty index and discrimination index were considered as P and D respectively and discrete formulae were used to difficulty and discrimination index respectively.

$P$  (Difficulty Index) = Number of correct

answers/Total respondents.

If the P values is Zero, which showed that the question was difficult.

For Discrimination index (D), Higher group (HG) and Lower group (LG) were formed, the higher group contains highest scorer students (number of correct answers from top 27% of respondents) and lower group contains lower scorer students (number of corrects answers from bottom 27% of respondents).

$D$  (Discrimination Index) =  $\frac{HG - LG}{27\%}$  of the respondents.

The range of difficulty index and discrimination index were adopted (Haladyna et al., 2002) of this study, thus are shown in table1 and table 2.

**Table 1** Difficulty Index (P) range

Sl. No	Range (0 - 1)	Illustration
1	<0.30	Difficult to Understand
2	0.30 - 0.70	Moderately Acceptable
3	>0.70	Easy

**Table 2** Discrimination Index (D) range

Sl. No	Range (-1 to +1)	Illustration
1	0 - 0.20	Poor Discrimination (must modify)
2	0.21 -0.30	Moderate Discrimination (conceivably revision needed)
3	0.31 - 0.40	Reasonable Discrimination (partially revised)
4	>0.41	Good Discrimination (acceptable)

### Results

A comparative study was carried out between two groups (Group A&B), which is shown in table 3.

**Table 3** Analysis of Difficulty and Discrimination Index of groups

Items	Group A		Group B	
	Difficulty index (P)	Discrimination Index(D)	Difficulty index (P)	Discrimination Index (D)
Q1	0.52	0.77	0.64	0.90
Q2	0.91	0.94	0.64	0.73
Q3	0.98	0.94	0.87	0.94
Q4	0.91	0.88	0.24	0.23
Q5	0.91	0.87	0.89	0.84
Q6	0.44	0.59	0.33	0.74
Q7	0.87	0.88	0.18	0.50
Q8	0.85	0.88	0.58	0.81
Q9	0.37	0.72	0.49	0.74
Q10	0.28	0.47	0.18	0.49
Q11	0.52	0.77	0.64	0.90
Q12	0.39	0.94	0.62	0.73
Q13	0.98	0.94	0.80	0.78
Q14	0.91	0.88	0.24	0.23
Q15	0.89	0.87	0.89	0.84
Q16	0.44	0.59	0.36	0.74
Q17	0.87	0.88	0.27	0.48
Q18	0.85	0.89	0.56	0.81
Q19	0.37	0.72	0.49	0.74
Q20	0.26	0.47	0.33	0.56
Q21	0.52	0.77	0.60	0.81
Q22	0.91	0.95	0.67	0.72
Q23	0.98	0.94	0.87	0.69
Q24	0.91	0.88	0.31	0.31
Q25	0.91	0.87	0.89	0.84
Q26	0.44	0.65	0.38	0.74
Q27	0.87	0.88	0.31	0.49
Q28	0.85	0.89	0.56	0.81
Q29	0.37	0.72	0.44	0.75
Q30	0.26	0.53	0.36	0.56

Difficulty index (P) has been used to identify the challenge faced by the students while answering the questions. In contrast, Discrimination index (D) has been used to measure of the validity of an item (question) between those who scored high marks and low marks in the exam. In this study, table 3 shows the analysis of Difficulty and Discrimination Index of groups (Group A&B), thirty MCQ items were used for this study, majority of the items were acceptable ( $D > 0.4$ ). Participants from both groups (Group A&B), felt that item 10 was difficult at the range of  $P=0.28$  and  $P=0.18$  respectively, furthermore the Discrimination index was acceptable at the range of  $D=0.47$  and  $D=0.49$  between groups. It showed that the choices in question were tough to answer, so respondents felt difficult to choose the correct option and respondents' could not understand the concept. Similarly, item 30 showed that only 26% (group-A) and 36% (group-B) participants were answered the question

appropriately, therefore it was evident that respondents were felt difficult to answer in both group A and B.

In group A, students realized that items 4, 14 and 24 were easy to answer with the difficulty index range  $P=0.91$ , in contrast group B students felt difficult for the same items with the difficulty index range of  $P=0.24$ ,  $0.24$  and  $0.31$  respectively. It showed that group B students could not understand the questions properly, it may be because of the instructor, might taught trivial concepts and provided least important to group B students. Interestingly, items 9, 19, 20, 26 and 19 were acceptable discrimination index ( $D > 0.4$ ) for both groups (Group A&B) but proportion of right answers in difficulty index ( $P=0.30 - 0.70$ ) was moderately acceptable. This showed that these items were puzzling to choose the right answer and instructor designed the options and questions infinitely.

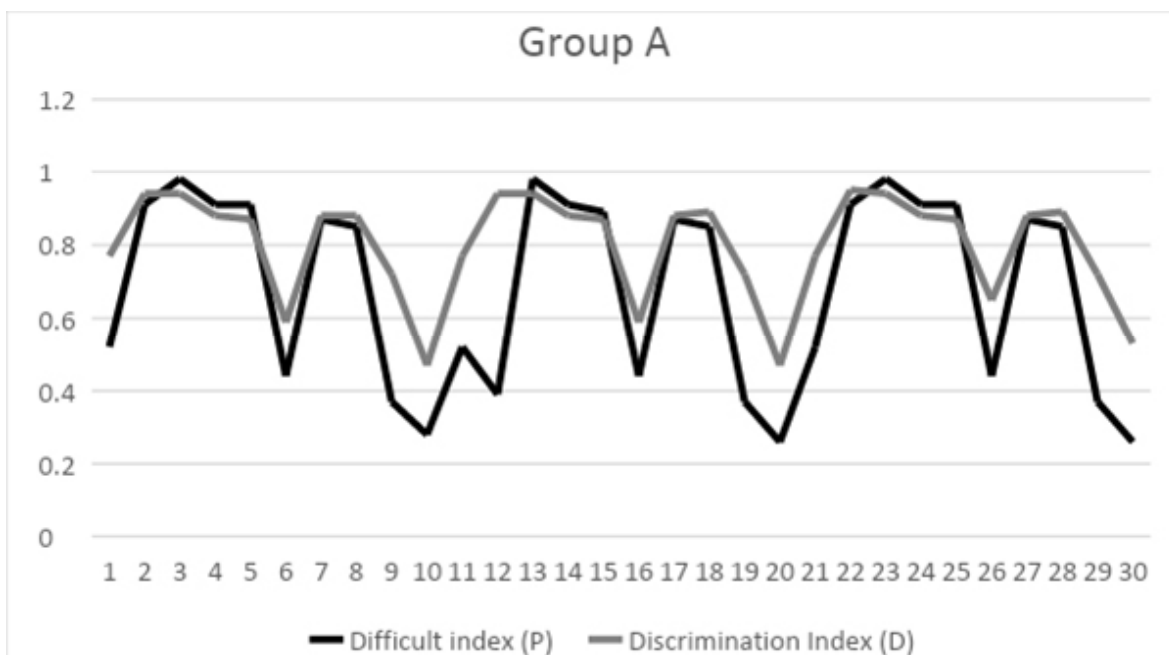
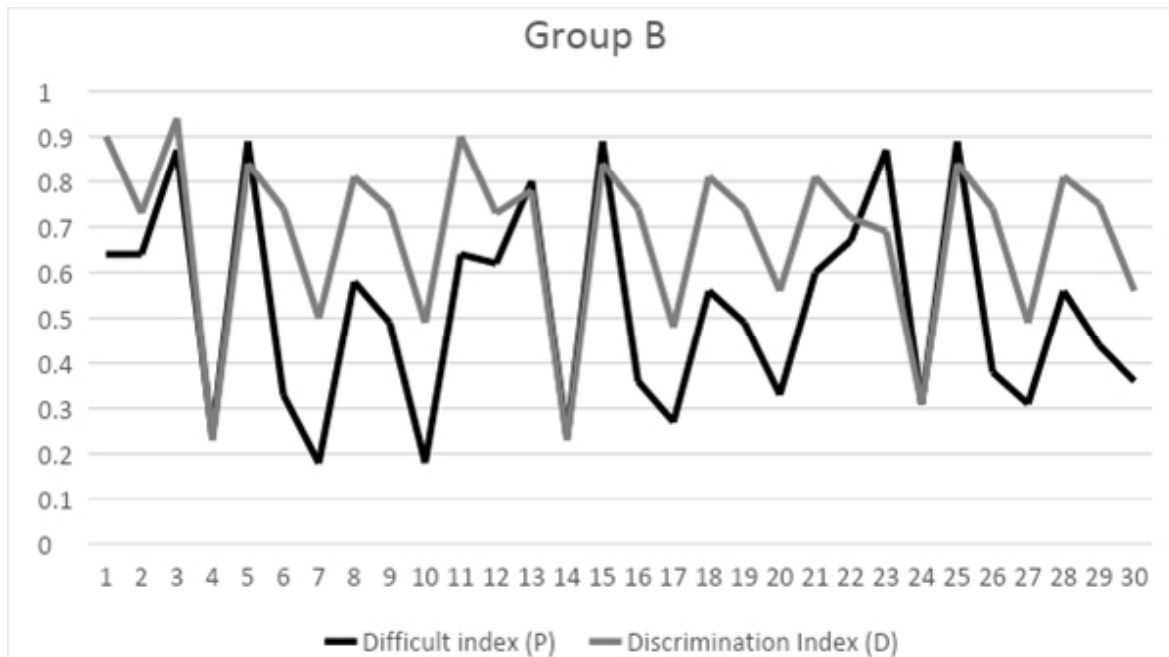


Figure 1.1 Group A - Difficulty and Discrimination Index

The figure 1.1 shows the comparison of difficulty index (P) and discrimination index (D) in Group A. The difficulty index (P) exhibited that items 9, 10, 12, 19, 20, 29 and 30 were not answerable by the students (P=0.37, 0.28, 0.39, 0.37, 0.26, 0.37, 0.26)

nonetheless it showed acceptable (D=0.72, 0.47, 0.94, 0.72, 0.47, 0.72, 0.53) discrimination index. The result showed that questions were standard and unintended so students felt problematic to understand the concept.



**Figure 1.2 Group B - Difficulty and Discrimination Index**

The figure 1.2 shows the comparison of difficulty index (P) and discrimination index (D) in Group B. The Questions or items 6, 7, 10, 16, 17, 20, 26 and 27 were very tough to comprehend (P=0.33, 0.18, 0.18, 0.36, 0.27, 0.33, 0.38, 0.031) however questions were acceptable with the discrimination index (D= 0.74, 0.50, 0.49, 0.74, 0.48, 0.56, 0.74, 0.49). In contrast, questions 4, 14 and 24 indicated that these questions were difficult to understand (P=0.23, 0.24, 0.31) moreover it showed poor discrimination index (D=0.24, 0.23, 0.31), therefore the reason could be either difficult to understand or different conceptual to them. The result showed that among thirty questions, three

questions were identified as poor discrimination index (D), therefore modification has to be carried out.

### Discussion and Conclusion

From the Table 3, it is observed that Group A and Group B students felt difficult to answer questions or to identify the correct answer. In addition, the discrimination index (D) has been analysed, the result showed that all the questions were acceptable in group A, on contrast items 4, 14 and 24 had poor discrimination in group B, which are to be removed or modified. From the comparison, it was observed that group B

students are challenged to cope with the given questions, hence this was evident of the mediocrity in learning levels amongst learners and the responsibility in turn lies with the course instructor to render essential specific inputs to the stakeholders.

From the statistical analysis, it was found that there were an impact and cause of Difficulty and Discrimination index in formative assessment between groups (Group A&B). On the whole Group B students were sensed that difficulty index (P) in MCQs were hard-hitting and problematic to answer. On the other hand, Group A students felt easier than B, moreover both groups (A&B) were acceptable discrimination index (D). The language instructors could motivate the students using various motivational strategies (Saranaj et al., 2014, pp.462), to inculcate the learning concept logical and easier, in addition students of group B have to involve in learner's autonomy. From this study, it showed that difficulty index and discrimination index were used to identify the learner's level of understanding the concept. This type of analysis should be used in formative assessment to uplift the students learning level and to get good score or grade in their end semester or course or programme. Formative assessment is inevitable in recent teaching learning process because it helps to monitor student's strengths and weaknesses through continuous assessment so that mentor can provide solution to the problem instantly and it reduces learners' dependence. In addition, it is effective way to validate the questions of formative assessment and to identify student's proficiency in the particulate subject. As a result, formative assessment is required to experience better learning and to uphold student's career.

### **Limitations**

This study is limited to formative assessment, technical English, first year technical students,

convenient sampling, difficulty index and discrimination index. In addition, further study can be extended to other summative assessment, other subjects, disciplines, domains such as Arts and Science, Medicine, Pharmacy, Management studies and so on in Indian context.

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