Original Article

A Study on Examination Results Using Six Sigma Process

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Abstract - *In this paper, an attempt was made to analyze the semester examination results for different mathematics courses offered by the Engineering Department using Six Sigma levels. Arbitrary weights are assigned depending on the importance of the courses in the level, and weighted Six Sigma levels are obtained.*

Keywords - *Defectives per million, Weighted defectives per million, Sigma levels, Examination results.*

1. Introduction

In six sigma, an institution is classified into three, namely non-competitive average, world-class (Mikel Harry (1998). [2], James Lucas (2002). [3]). In an institution, examination is the main process. An examination is a formal test that one can use to show knowledge (or) ability in a subject. Different subjects will have different weights. Hence, it is not correct to keep the same weight for all subjects. In Engineering courses, some of the courses will be prerequisites to other courses. A prerequisite course is a course that must be finished or passed before studying the other courses.

If a student fails to clear a prerequisite course, then it will delay his/her movement to the next level of study. In this paper, let us consider three mathematics courses namely Mathematics 1, Mathematics 2 and Mathematics 3. An Institution that starts improving processes and quality can call themselves a "Six Sigma Organization" (Fred McFadden (1993). [1], Fontenot (1994). [4]).

Mathematics-1 is a prerequisite course for Mathematics 2, Applied Operations Research, Fundamentals of Physical Chemistry, Signal System, Control System, Digital Signal Process and Numerical Methods, which is being offered at the diploma level. Mathematics-2 is a prerequisite course for Mathematics 3, Chemical Reaction Engineering, Chemical Process Dynamics, Instrumentation and Control and Computer-Aided Design, which is being offered at the advanced diploma level.

Mathematics-3 is offered at the Bachelor level. If a student fails the mathematics 1 course, it will delay his/her graduation, and the student cannot take other courses; subsequently, his/her CGPA also. Hence, it is not logically correct to keep the courses at the same weight. Ravichandran (2006).[5], (2009).[6] studied performance evaluation of education institutions using sigma levels and Ravichandran (2009).[6] studied different branches offered by the institution using the weighted average concept.

The importance of the weighted mean concept, along with the Six Sigma process, has not been used by researchers in analyzing the examination results so far.

The results of various courses are compared with equal weights. Here, an attempt is made to compare with unequal weights depending on the importance of the course at that level. A set of tools to eliminate defects and to improve the quality process is used. Six Sigma techniques are used to compare the results. In this paper, we studied the importance of the various mathematics courses in our department. All the mathematics courses will not have the same weightage. Hence, we have been given different weights depending on the course, and analyses are made accordingly.

2. Data and Failure Rates

Data on failure rates for different mathematics courses for a period of three semesters from 2021 – 2024 are shown in the table.

Table 1. Failure rates for different mathematics courses

Batch	Course	Number of Students Appeared	Number of Students Failed (F)	F/A
2021-2022	MATHEMATICS-1	563	100	0.1776
	MATHEMATICS-2	567	96	0.1693
	MATHEMATICS-3	287	17	0.0592
2022-2023	MATHEMATICS-1	631	89	0.1411
	MATHEMATICS-2	477	81	0.1698
	MATHEMATICS-3	204	2	0.0098
2023-2024	MATHEMATICS-1	331	48	0.1450
	MATHEMATICS-2	317	47	0.1483
	MATHEMATICS-3	111	1	0.0090

3. Weighted Sigma Level

The purpose of quality function deployment is based on important ratings obtained because of stakeholders. Ravichandran (2009) discussed the importance of value-based evaluation. Since the course Mathematics 1 is a prerequisite to Mathematics 2 and other important courses in the diploma level in engineering, we fixed the weight for Mathematics 1 as 0.5. Mathematics 2 is a prerequisite to Mathematics 3 and other important courses in advanced-level engineering, we fixed the weight as 0.375 and for Mathematics 3, the weight is 0.125. The result of the failure rates is also given using equal weights and unequal weights.

Table 2. Sigma level with Equal Weights-Mathematics-I

WEIGH-BASED SIGMA LEVEL WITH EQUAL WEIGHTS FOR BATCH -MATHEMATICS-1				
Year	Weight	dpm	Weighted dpm	Sigma level
2021-2022	1/3	0.157943398	0.05	3.11970529206838
2022-2023	1/3	0.139752654	0.05	3.17891589811314
2023-2024	1/3	0.145015106	0.05	3.16118280790894

MATHEMATICS-1 Sigma Level

Fig. 1 Sigma level with Equal Weights-Mathematics-I
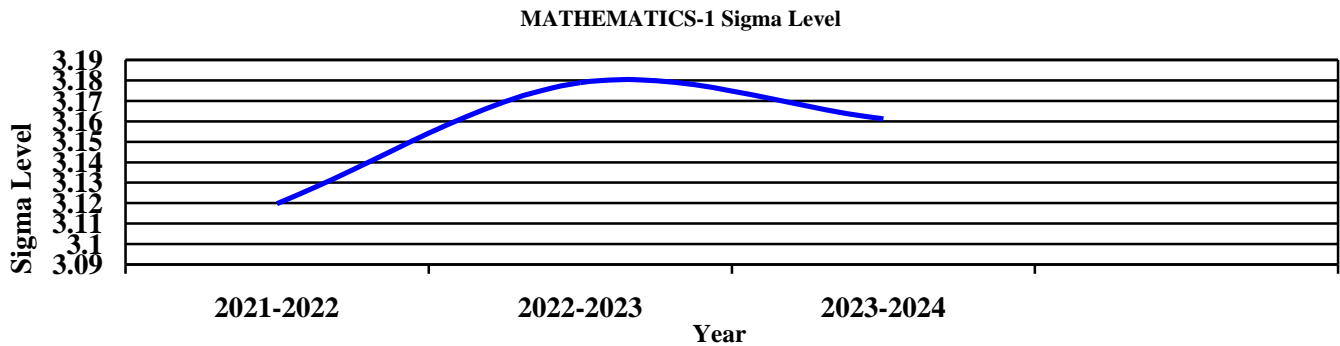
MATHEMATICS-1 Sigma Level
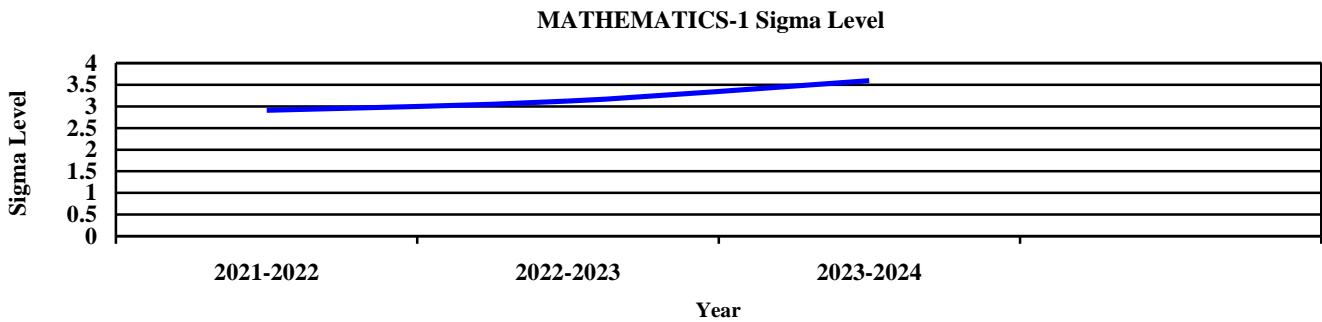

Fig. 2 Sigma level with Unequal Weights-Mathematics-1

Table 3. Sigma level with Unequal Weights-Mathematics-1

Weight Based Sigma Level with Unequal Weights for Batch-Mathematics-1				
Year	Weight	dpm	Weighted dpm	Sigma level
2021-2022	1/2	0.157943398	0.08	2.91202228934999
2022-2023	3/8	0.139752654	0.05	3.12194796523309
2023-2024	1/8	0.145015106	0.02	3.59406964676445

From Figures 1 and 2, it is evident that there is a change in sigma level, and the student should concentrate more on Mathematics 1 than other subjects at the diploma level.

Table 4. Sigma level with Equal Weights-Mathematics-2

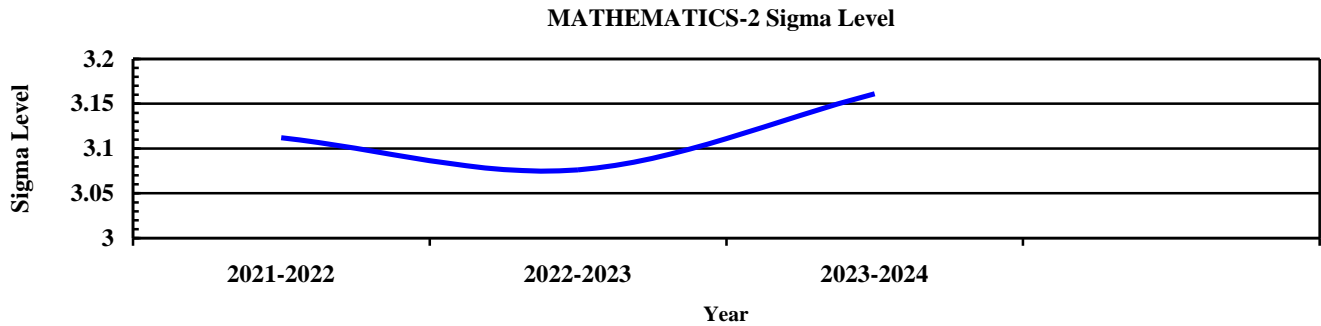| Weight Based Sigma Level with Equal Weights for Batch-Mathematics-2				
Year	Weight	dpm	Weighted dpm	Sigma level
2021-2022	1/3	0.160443723	0.05	3.11199750801944
2022-2023	1/3	0.172507168	0.06	3.07609123529632
2023-2024	1/3	0.145015106	0.05	3.16118280790894

Fig. 3 Sigma level with Equal Weights-Mathematics-2

Table 5. Sigma level with Unequal Weights-Mathematics-2

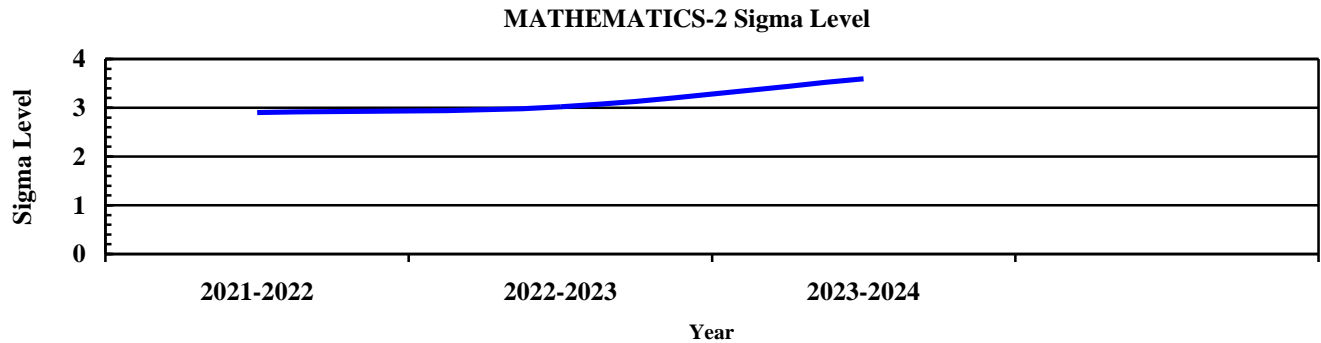| Weight Based Sigma Level with Unequal Weights for Batch-Mathematics-2				
Year	Weight	Dpm	Weighted dpm	Sigma level
2021-2022	1/2	0.160443723	0.08	2.90358077584062
2022-2023	3/8	0.172507168	0.06	3.01654984715420
2023-2024	1/8	0.145015106	0.02	3.59406964676445

Fig. 4 Sigma level with Unequal Weights-Mathematics-2

From Figures 3 and 4, it is evident that there is a change in sigma level, and the student should concentrate more on Mathematics 2 than other subjects at the advanced level.

Table 6. Sigma level with Equal Weights-Mathematics-3

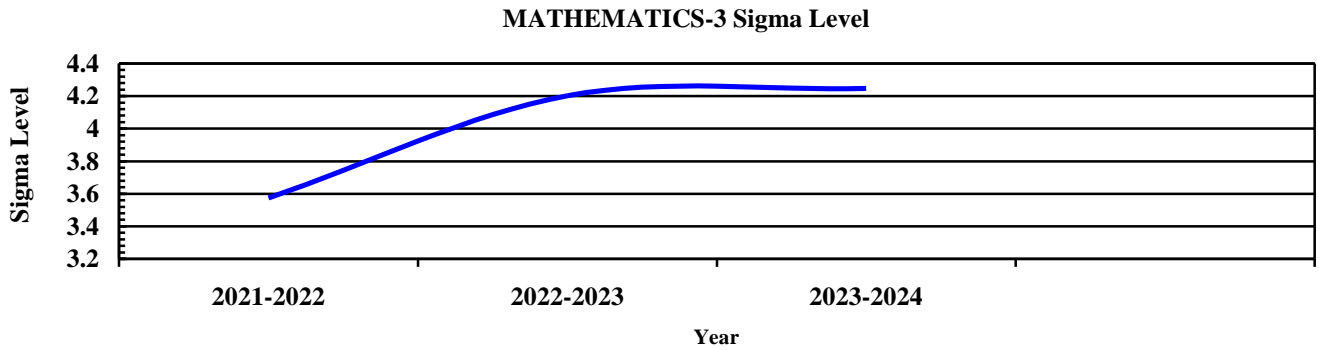| Weight Based Sigma Level with Equal Weights for Batch-Mathematics-3				
Year	Weight	dpm	Weighted dpm	Sigma level
2021-2022	1/3	0.057177573	0.02	3.57357948617072
2022-2023	1/3	0.010329114	0.00	4.20230404981928
2023-2024	1/3	0.009009009	0.00	4.24745330729772

Fig. 5 Sigma level with Equal Weights-Mathematics-3

Table 7. Sigma level with Unequal Weights-Mathematics-3

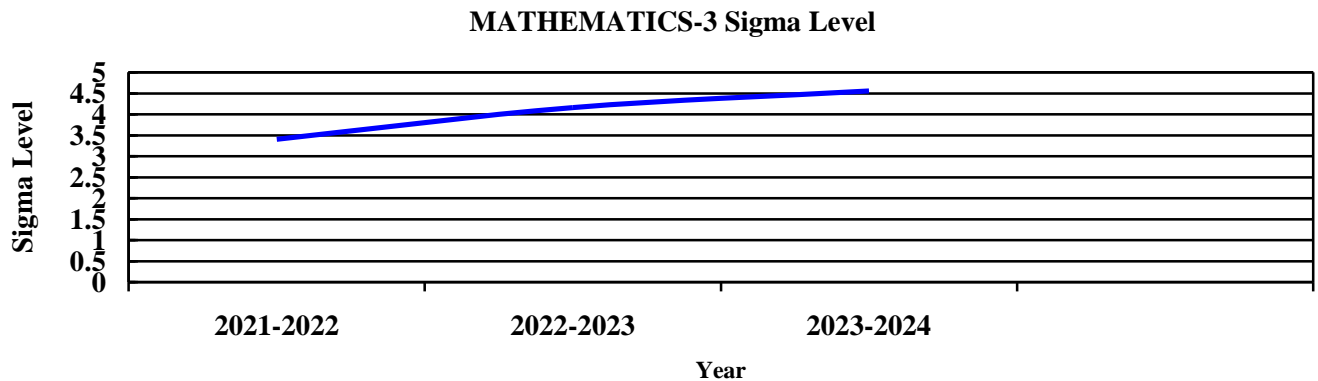| Weight Based Sigma Level with Unequal Weights for Batch-Mathematics-3				
Year	Weight	dpm	Weighted dpm	Sigma level
2021-2022	1/2	0.057177573	0.03	3.40195090701887
2022-2023	3/8	0.010329114	0.00	4.16290902611646
2023-2024	1/8	0.009009009	0.00	4.55478058982079

Fig. 6 Sigma level with Unequal Weights-Mathematics-3

In the future, an attempt will be made to compare the results with those of other institutions. Also, an attempt will be made to analyze the results with credit hours using weighted mean concept and six sigma levels.

4. Conclusion

In this paper, an attempt is made to analyze the semester examination results for different mathematics courses using Six Sigma levels. Arbitrary weights are assigned depending on the importance of the courses in the level, and weighted sex sigma levels are obtained. From all the above graphs, we observe that importance should be given to Mathematics 1 and Mathematics 2 as it is a prerequisite course for some of the engineering courses. There is a good improvement in the results with unequal weights. A similar attempt will be made for credit hours and will be communicated later.

Authors Contribution:

Dr. V. Ganesh-Problem identification, introduction writing

Dr. M. Chandrasekaran-Literature survey, statistical analysis

Ms. V. Sharada-Methodology investigation, data collection and analysis,

Dr. S. Lavanya-Problem solving, conceptualization

References

[1] Fred R. McFadden, "Six –Sigma Quantity Program," *Quality Progress*, vol. 26, no. 6, pp. 37-42, 1993.

[2] Mikel J. Harry, "Six Sigma: A Breakthrough Strategy for Profitability," *Quality Progress*, vol. 31, no. 5, pp. 60-64, 1998. [Google Scholar]

[3] James. M. Lucas, "The Essential Six Sigma," *Quality Progress*, pp. 27-31, 2002. [Google Scholar]

[4] Gwen Fontenot, Ravi Behara, and Alicia Gresham, "Six Sigma in Customer Satisfaction," *Quality Progress*, vol. 27, no. 12, pp. 73-76, 1994. [Google Scholar]

[5] J. Ravichandran, "Six Sigma Milestone: An Overall Sigma Level of an Organization," *Total Quality Management & Business Excellence*, vol. 17, no. 8, pp. 973-980, 2006. [CrossRef] [Google Scholar] [Publisher Link]

[6] J. Ravichandran, "Performance of an Education Institution Using Sigma Levels of Exam Results," *Proceedings of National conference on Quality Improvement Concepts and their Implementation in Higher Educational Institutions*, pp. 78-86, 2009.