

A comparative study on rubrics and its impact on program outcomes for the project work of under graduate program

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Abstract: The National board of accreditation (NBA) has specified the program outcomes for all programs, which are the prime focus for outcome based education in present engineering education system. With the project work of under graduate program, one can achieve the maximum number program outcome, as this subject comes beyond the boundaries. In their final year project, the student has been assessed on the basis of preparedness for industry, practical knowledge, communication skill, writing skills and other professional skills required for engineering profession. The rubrics of evaluation plays an important role, as correctly constructed rubric will result in a time efficient and consistent grading process for both teacher and student. The objective of this paper is to perform the comparative study on rubrics for two academic years and to measure its impact on program outcomes. In the present evaluation system three phases for the project evaluation have been taken and for each phase rubrics are clearly defined, then program outcomes have been calculated for each phase. Further, the results with this system of evaluation have been discussed in detail. The evaluations of the project by an industry expert which help to bridge the gap between industry and academia has also been discussed. The proposed rubric shows better results towards the distribution of the grades and attainment of program outcome for the same course outcome in two different academic years.

Keywords: *Rubrics; course outcomes, Program outcomes evaluation.*

1. Introduction

The final year engineering project work showcases students' knowledge which they have acquired over the duration of the whole course and is a basis for a better carrier. The former projects were evaluated by a committee formed by several professors [1]. The evaluation was mainly based on a report, power point presentation and hardware or software demonstration of the projects.

Evaluation of all these aspects together gives rise to a grade for the FYP(Final Year Project). Later the need for rubrics has arisen and some institution started following the proper rubrics from past few years for the evaluation of project. Most of the institutions do not provide the rubrics to be considered for the grading of their final year projects, which has the maximum number of credits as compare to other courses students have taken during the program. On the other hand, rubrics will not only set a clear blueprint for an assignment, but also by defining and clarifying expectation in terms of rubrics will encourage authentic work as well as self-assessment by students about their work. The well-designed rubrics for the final year project work can help to achieve the maximum number of program outcomes. This paper presents the rubrics for the assessment of the final year project work in three different phases.

2. Literature review

Some research work has been done in recent past about the process of assessment of the final year project. In this regard Valderrama established a design procedure in six stages for assessing the FYP of the bachelor's degree [1]. Those stages together with recommendations are:-a) Learning outcomes definition for the FYP and assignment of a set of objective descriptors to each one. b) Definition of assessment milestones: Who and what will assess each descriptor. c) Descriptors assignment to each assessment action. d) Definition of level of compliance for each descriptor establishing a clear and objective level of compliance to be satisfied by the student. e) Assessment report. f) Qualification. The faculty or college must define the criteria to be followed in order to provide the students. M. Villamañe [2] presented a system developed to support both lecturers and students and lighten the problems in final year project evaluation. Mr. Alan Chong, University of Toronto [3] focused on four central design considerations: (a) Number and naming of performance categories, (b) Numerical equivalents, (c) Generality versus specificity in

the language of the performance criteria. Sanchez, J.L., González [4] explained the procedure to ensure the evaluation of a subset of skills of high interest for entrepreneurs. On the other hand, Teo [5] introduces five assessment components: 1) Interim assessment with a weight of 15%, named S1, 2) Report and final assessment with a weight of 50%, named S2, 3) Oral presentation with a weight of 5%, named S3, 4) Report and demonstration with a weight of 25%, named M1 and 5) Oral presentation with a weight of 5%, named M2.

Literature review explains that the process of evaluation was mainly on the basis of learning outcomes, assessments, performances, skill development for enterpreneur etc. In the work presented in paper different rubrics were formed for each phase of project so that more aspects of the evaluation and program outcome have been addressed.

The main objective of the present work can be defined as:-

1. Comparison of rubrics for two academic years and to measure its impact on program outcomes.
2. Study the effect of new rubrics framed for the current academic year on the final grading of the students.
3. Study the impact of more number of evaluator in the project evaluation committee resulting in impartial evaluation for the individual student in FYP.

3. Design Of Rubrics And Phases Of Evaluation

A. Course outcomes for the project:- For the formation of the rubrics for each phase first the program outcome should be known and accordingly the rubrics can be planned. The project work outcomes have been defined as follows:-

- CO1: Ability to search literature, and formulate a complex engineering problem.
- CO2: Apply the fundamental knowledge of mathematics, science and engineering principles in design of solutions of system components.
- CO3: Identify, Select, and apply a suitable engineering/IT tool in modelling/data interpretation /analytical studies, conduct experiments leading to a logical solution.
- CO4: Design a system/ system component/process, build it and test its functioning as a solution to a complex engineering problem.
- CO5: Communicate effectively to a diverse audience and develop technical reports and publication.

Course outcomes with program outcomes has been mapped for each phase and shown in below paragraphs. The reference for the rubrics formation is as shown in Fig1.

B. Project first phase:- In the first phase of the project, students are evaluated for the skills of defining the problems which they have selected for their project work and depth of the literature survey they have performed to arrive at that problem. Even the capability of working in a group need to be tested to some extent. They clarify the students about the qualities of their work, helps instructor to instruct in right track and evaluator to assess correctly. Attainment of the CO (Course outcomes) and program

outcomes are shown in Table I The sample rubrics for the first phase of the project have been shown in Table-II.

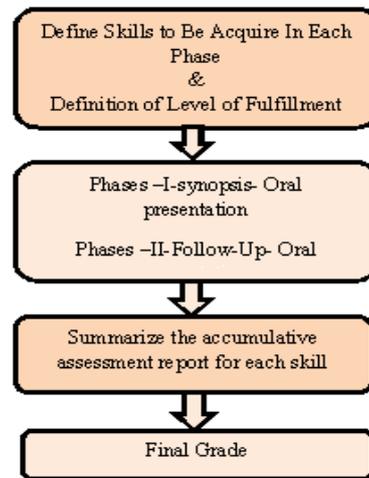


Fig.1. Reference for the rubrics formation for the project

PHASE-1 CO-PO		
CO-PO	Students	Marks
CO1- Attainment	0.844156	0.824675
CO2-Attainment	0.714286	0.716883
CO3-Attainment	0.711039	0.785714
CO5-Attainment	0.824675	0.828571
PO1- Attainment	0.211039	0.206169
PO2- Attainment	0.422078	0.412338
PO3- Attainment	0.17776	0.196429
PO4- Attainment	0.17776	0.196429
PO5- Attainment	0.17776	0.196429
PO9- Attainment	0.412338	0.414286
PO10- Attainment	0.412338	0.414286
PO11- Attainment	0.149959	0.152192
PO12- Attainment	0.338068	0.340422

Table-I. CO-PO mapping for the first phase of evaluation

C. Project Second phase:- In the second phase of the project students need to be evaluated for the skills such as their depth of understanding, their presentation style, their team work and their ability of estimating and costing. The sample rubrics for the second phase of the project have been shown in Table-III. Mapping of the CO (Course outcomes as per number of Student and marks) and PO(Program outcomes) are shown in table IV.

PHASE-2 CO-PO		
	Students	Marks
CO1- Attainment	0.772078	0.772078
CO2-Attainment	0.766234	0.776623
CO3-Attainment	0.833766	0.833766
CO5-Attainment	0.842857	0.842857
PO1- Attainment	0.386039	0.386039
PO2- Attainment	0.383117	0.388312
PO3- Attainment	0.208442	0.208442
PO4- Attainment	0.208442	0.208442
PO5- Attainment	0.416883	0.416883
PO9- Attainment	0.421429	0.421429
PO10- Attainment	0.421429	0.421429
PO11- Attainment	0.208442	0.208442
PO12- Attainment	0.625325	0.625325

Table-II
Sample rubrics for project phase one

Table-III
Sample rubrics for project phase two
D.Pr

Table-. CO-PO mapping for the second phase of evaluation

Project Final phase:-

In the final phase of the project the thoroughness of student's work should be evaluated as per project time

Rubrics for Project Phase 1							
S.No	Criteria	CO Mapped	PO Mapped	Max Mark	Marks obtained >70%	Marks obtained 40 to 70%	Marks obtained <40%
1	Problem Definition (Synopsis, Activity Chart)	CO1	PO1,PO2	10	Has made a thorough evaluation through comparisons	Has made a fair evaluation of the resources	Has some idea of the usefulness of the information resources available
Rubrics for Project Phase II							
2	Literature Survey	CO2	PO12	5	Has clarity on the information on the topic available	Has fair idea about the information on the topic available	Has a basic idea about the information on the topic available
3	Methodology Implementation	CO3	PO3,PO4	5	Moderate amount of novelty in the methodology.	A little different from what exists	Very ordinary. Already exists
4	Activity Chart for implementation	CO3	PO5	5	Flashes on the dot well aware and confident about it	moderately aware	Fairly aware
5	Presentation Content Design & analysis and Communication	CO2	PO10	10	Has fine creativity in the slides. Follows the logical sequence, and has organized the slides in a sequence	Slides are moderate. Has fair idea about the information on the topic available	Slides are moderate, has moderate structure and information on the topic available
6	Depth of Understanding implementation	CO3	PO3,PO4	5	Answers most questions and writes answers with clarity about it	Answers a few questions moderately aware with moderate clarity	Presents with moderate clarity but does not answer questions
7	Implementation As per activity chart	CO1	PO11,PO12	5	complete the activity. Has fine creativity in the slides. Follows the logical sequence, and has organized the slides in a sequence	complete 40-70% of the activity. Slides are moderate, work done by Individual moderately complements the total work	complete < 40% of the activity. Slides are moderate, work done by Individual fairly complements the total work
8	Content and Team work Communication	CO5	PO9	5	work done by Individual substantially complements the total work	work done by Individual moderately complements the total work	work done by Individual fairly complements the total work
9	Cost estimation and finance	CO3	PO3,PO4,PO12	5	Well aware of the Finance and has economized	Moderately aware of cost estimation and presents with moderate clarity	Fairly or not aware of cost estimation but does not answer questions
Total Marks				50			
6	Phase two result & discussion	CO1	PO11,PO12	10	Has clarity on the results obtained	Has fair idea about the results obtained	Has a basic idea about the results obtained
7	Team work	CO5	PO9	5	work done by Individual substantially complements the total work	work done by Individual moderately complements the total work	work done by Individual fairly complements the total work
8	Cost estimation and finance	CO3	PO11,PO12	5	Well aware of the Finance and has economized	Moderately aware of cost estimation	Fairly or not aware of cost estimation
Total Marks				50			

lines and guidelines and in the final phase one of the

evaluator was from the industry to evaluate relevance of the project with industry. A sample rubric for the final phase has been shown in the table V. The CO- PO mapping for the final phase has been shown in table-VI.

	Students	Marks
CO4- Attainment	0.98	0.901299
CO5-Attainment	0.986667	0.903896
PO4-Attainment	0.98	0.901299
PO10--Attainment	0.986667	0.903896

Batch	Name of student	USN	Title of Project	Guide	Demonstration of working of prototype	Organize the report into a relevant structure	Presentation of results and discussions	The possibility of the work resulting in a publication	Total
					20	10	10	10	50
PB1	JHA NIKHIL TARKESWAR	1BM13EE020	PERFORMANCE EVALUATION OF A BIFURCATED WINDING INDUCTION GENERATOR (BWIG) DURING DYNAMIC VARIATIONS IN WIND SPEED	Dr.PM	20	10	9	9	48
	PRADEEP DESAI - SATHYA SHEELAN S -	1BM13EE038			20	9	9	9	47
	SHAIK KHALID AHMED -	1BM13EE047			20	9	9	9	47
		1BM13EE048			20	10	9	9	48
PB2	CHINMAYI MOHAN	1BM13EE016	DISCHAGE BASED GAS CLEANING WITH NEWLY DEVELOPED HIGH VOLTAGE ROTARY SPARK GAP SWITCH	Prof. DRK	19	10	9	10	48
	DEEKSHA HC -	1BM13EE017			19	10	9	10	48
	M SHEYAMALA -	1BM13EE025			19	10	9	10	48
	PRIYANKA KALI WAL -	1BM13EE039			19	10	9	10	48

Table-VI. co-po mapping for the Final phase

Table-VII Sample for the evaluation sheet for the project committee

Rubrics for Project Phase III							
S.No	Criteria	CO Mapped	PO Mapped	Max Mark	Marks obtained >70%	Marks obtained 40 to 70%	Marks obtained <40%
1.	Demonstration of working of prototype /simulation for its intended operation, Response to Q & A	CO4	PO 4	20	Very clear and free in operation during the demo and responsive to questions and answer and intended task completed.	Moderately clear and fairly responsive to questions and answers , intended task not fully complete	Fairly clear, not aware of the details .Lots more scope for
2.	Organize the report into a relevant structure	CO5	PO10	10	The report is well formatted and is in the prescribed format	The report is not formatted but is in the prescribed format	The report is fairly formatted and fairly follows a structure
3.	Presentation of results and discussions	CO5	PO10	10	Well defined graphs that are labeled with captions as per the prescribed format	Moderately presented	Fairly presented
4.	The possibility of the work resulting in a publication	CO5	PO10	10	Results obtained are worthy of a good publication	Moderately worthy, some more results needed	Fair, not worthy of a publication
		Total Marks		50			

Table-V Sample rubrics for project Final phase

E. Project Evaluation and final grading:-

All the three phases' rubrics have been provided to the evaluation committee. Evaluation committee has been formed with four external members (Non-Guide) and one internal member (Guide). Members and then the average marks of all the members have been calculated as per the sample shown in table VII. One aspect of evaluation was also to assess the project by industry expert which was tough on the basis of bridging the gap between industry and academia and also make the student ready for industry. Finally, the average Course outcome from all the three phases has been plotted as shown in fig.2 & fig-3.

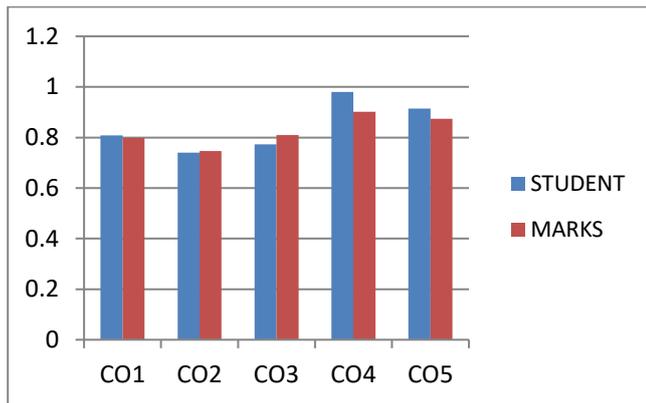


Fig-2 CO – mapping for the project work on basis of student and marks

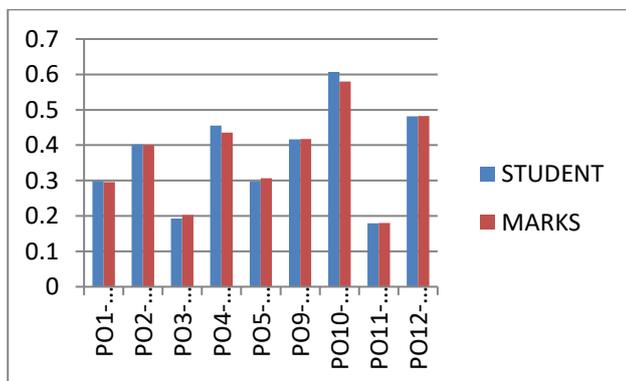


Fig-3 PO – mapping for the project work on basis of student and marks

F. Comparison of previous rubrics with the rubrics presented:-

With the previous rubrics the grades obtained by the students in SEE (Semester end examination) are compared with the grade obtained by present evaluation system are shown in table VIII and fig-4 respectively. From the table VIII we can observe that the grades are distributed more uniformly (forming a bell curve, which is desirable) than the previous year.

GRADE	A	S	B
No Of Students (With Present rubrics System)	30	42	3
No Of Students(With Previous rubrics System)	20	57	0

Table-VIII. Comparison of grades for the academic year 2016 and 2017

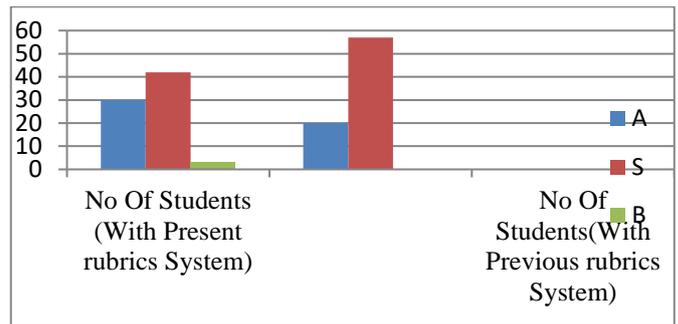


Fig-4 Graph for Comparison of grades for two different rubrics system for the academic year 2016 and 2017

Finally it can be concluded that due to the implementation of different rubrics for different phases more number of program out comes could be achieved and rigorous evaluation process could be followed for the FYP.

4. Conclusion

The project has been evaluated as per the rubrics provided to the students and the evaluators. Prior to the evaluation, it provides a clear idea to the students that at what basis they are going to be evaluate and also to the evaluators. In the present evaluation system the number of evaluators was more, so it gives seriousness to the student, as well as impartial judgment for their project work. The grades are distributed which is essential in outcome based education system. The evaluation done by expert from industry will provide the idea about their preparedness for industry.

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