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Inter-retaliatory Student Projects as Part of Evaluating Practical Knowledge with the Assist of Novel Assessment Technique

Riaz Kurbanali Israni, *riaz.israni@rku.ac.in, Assistant Professor, Department of Electrical Engineering, School of Engineering, RK University Kasturbadham, Bhavnagar – Rajkot Highway, Near Tramba, Rajkot-360020*

Abstract

This paper enlightens on the enrichment of students in practical aspects rather than by regular lecture sessions. We at RK University came up with a new initiative of introducing inter-disciplinary student projects for the Department of Computer engineering, Electrical engineering, Electronics & Communication Engineering& Mechanical Engineering. The approach was that the students of diploma 5th semester of above-said branches will come together in a group of maximum six students to design & develop a prototype model with a specific application in compliance with domestic and industrial needs. The main objective was to make them aware of other disciplines that how things are managed irrespective of the hurdles in their way and to understand basic fundamentals of other branches. This paper showcases the course evaluation methodology, rubrics components and flow of progress of project work. Hence culmination of domestic/industrial needs with practical knowledge of the prototype models would meet their expectations.

Keywords **—** Inter-disciplinary project work, Innovative assessment, Team-coordination

JETLP Category **—** Review Article

1. Introduction

In today's era, there is a great need to have substantial changes in the education system. Looking at the rapid changes in the current scenario and expectations by the industry we must be ready to be ready to incorporate the respective talent in the existing students who are soon going to graduate. It is thereby important to make the students equipped with the respective skill sets which industry will require being more productive ultimately [1].

There are many reasons which are hindering the students from being able to survive the competitive environment. Some of those challenges will include their lack of knowledge, lack of eagerness to work, lack of eagerness to take initiative, and so on. The prime reasons due to which these qualities are seen in the student are due to the stereotypic syllabus which is delivered to them [2]. One should be ready to the rapid changes in order to observe a drastic change in the existing students and thereby making them ready as per the current industry standards.

It is required that they start thinking out of the box and start to experiment new and innovative concepts and ideas which can impart critical thinking and eagerness to innovation in them. This can only be done if they are allowed to explore the beauties of engineering in terms of making them work on hands-on projects. This can help them to identify the key areas which they like the most to work and thereby can experiment with them and build an innovative model [3].

With this viewpoint, we have decided to have the concept of mini-project as a part of the curriculum which can make it possible for the students to explore engineering concepts in greater depth [4]. Even it is required that this exploration doesn't remain limited to a particular branch of Engineering. In order to make it wide enough, it was decided to make it multi-disciplinary where students from multiple engineering branches can come together and develop a prototype or a model. The multi-disciplinary concept was mainly intended to have a more productive output. It will be mainly possible as when they are working on any of the practical projects they can equip with the latest technology as they are also having the support of other branches of Engineering [5]. This will help in having more productive ideas and models which can serve the basic purpose of the society and even generate innovative mindset among the students.

We have thereby incorporated this concept to have a fruitful outcome and also making the students do it as a part of the curriculum. This will motivate students as more effort they provide to this area, correspondingly they will get more output in terms of their final results. It will thereby result in more active participation from the side of the students and will encourage more models which can serve the current problems of the society.

2. Assessment Methodology

In the students project work, the course evaluation methodology includes only practical work. No any theory part will be assessed.

RK UNIVERSITY

COURSE EVALUATION METHODOLOGY

SCHOOL OF DIPLOMA STUDIES	PROGRAM : DIPLOMA – MECHANICAL ENGINEERING
ACADEMIC YEAR - 2017-18	SEMESTER –V BATCH YEAR : 2015
DEFINITION OF ONE CREDIT :	
1. Lecture(L): 0 hour / week / semester, **2. Practical(P)**: 1 hour / week / semester **3. Tutorial(T):** 0 hour / week / semester	

Course Code	Course Name	Teaching Hours			Credits	Audit course	CIE	PSEE	Remarks if any
		Theory	Tutorial	Practical					
DME518	Mini Project	0	0	1	1	N	N	Y	

	CIE			PCIE			TSEE	PSEE	Remarks
	CIE1	CIE2	CIE3	PCIE1	PCIE2	PCIE3			
	20 marks	20 marks	10 marks	20 marks	20 marks	10 marks	100 marks	50 marks	
	x	x	x	√	√	√	x	√	

N- No	CIE – Continuous internal evaluation
Y – Yes	PSEE – Practical semester end examination including ITD, Dissertation, Industrial project, Industrial training etc.
	TSEE – Theory semester end exam
	PCIE –Practical Continuous Internal Evaluation

Fig. 1 Course Evaluation Methodology for the Mini Project (DME518)

In this mini-project task all students have to fulfill the assigned criteria. As shown in the above figure, it clearly states that the proposed course comprises of the only practical component which indicates that the students of designated branches must fulfill all criteria in the execution of the project. Here with are the details of rubrics for the first two phase of assessment to be conducted for the different groups.

Rubrics for Power Presentation – Mini Project – PCIE 1 (40Marks)

CRITERIA	Excellent (6-7)	Good (3-5)	Average (1-2)	Poor (0)	Points
Content/Literature Review: Relates to topic, detailed, and accurate	All contents are directly related to the topic and always supported by facts.	All Contents are directly related to the topic and few are supported by facts.	All Contents are not directly related to the topic and only few are supported by facts.	Topics, facts & figures are not presented	/7
	Excellent (8-10)	**Good (4-7)**	**Average (1-3)**	**Poor (0)**	**Points**
Knowledge/Level of Understanding: Demonstrate knowledge of subject	Showed a deep and clear understanding of the topics during the presentation.	Showed a clear understanding of the topic but depth of the knowledge is not there.	Showed elementary knowledge of the topic.	No knowledge regarding the topic and progress of the work.	/10
	Excellent (5)	**Good (3-4)**	**Average (1-2)**	**Poor (0)**	**Points**
Communication, Elocution & Appearance	-communicates with excellent clarity and always uses scientific terminology	-communicates with good clarity and often uses scientific terminology	-communicates with some clarity and sometimes uses scientific terminology	-communication is poor with nil use of scientific terminology	/5
	-uses fluent speech and feels self-confident & relaxed	-voice is clear & pronounces most words correctly and feels little nervous	-voice is clear & pronounces incorrect terms and feels somewhat nervous	-voice is not clear	
	-completely formal & well dressed	-somewhat formal dressing. (no proper grooming)	-partially formal dressing. (no grooming & no formal shoes)	-no formal dressing	
	Excellent (8-10)	**Good (4-7)**	**Average (1-3)**	**Poor (0)**	**Points**
Responses to questions	-answers were well developed and displayed in depth understanding	-answers were good and showed good understanding.	-answers were partially complete but lacked depth of understanding.	-no questions were responded.	/10
	Excellent (6-8)	**Good (4-5)**	**Average (1-3)**	**Poor (0)**	**Points**
Progress of the work and team work	About to complete the project. Utilizes technical strengths of each team member to full advantage leading to productive interaction.	Mid way in the progress. Shows enthusiasm in understanding the work and coordinates with the group members (50%-75% work completed)	Behind the schedule. Minimal organization and planning with limited contributions of most team members. (<50% work completed)	Work has not started yet as there is no coordination with group members. (0% work)	/8

Fig. 2 Rubrics for PCIE-1 exam for assessment of the mini-project

Assessment of Mini project was planned during the 6th week of the commencement of the semester. It included few of the parameters over which students were accessed. Figure 1 is showing the parameters over which students were assessed for the progress which they have done during the on-going semester. These parameters were pre-communicated with the students to make them aware of how they are going to be assessed. It will help them to be ready for their project to score the most in their evaluation.

The parameters over which they were accessed are discussed here in brief:

1. Content/Literature Review: This parameter includes the pre-work which students have done before selecting their topic for the mini-project. It will help them to have a clear idea about the selection of the right topic and also to plan their way ahead [6].
2. Knowledge/Level of Understanding: In addition to background knowledge it is also required that students have a proper level of understanding which can help them to solve the issues which they might face during actual working of the project. It is required that they have their basics clear which will ultimately be highlighted in the output which is received from the project itself.
3. Communication. Elocution and Appearance: One can consider this as an important parameter to represent themselves and also their project in an effective manner to the audience. More effective is the communication mode will be the way of expressing their work to their guide.
4. Response to questions: This parameter is very crucial as concerned to the students because while replying to the questions they must be very clear regarding the work they carried out in the first phase of work and yet to be completed in next phase of the project. If they are not clear about the project then there is mere possibility that they will be responding to the questions [7].

5. The progress of the work &teamwork: Since it is a group activity that too inter-disciplinary, so it is important that members of the group are on the same page when they are talking about the project [7]. The progress of the work carried out by the group will be accessed in detail with respect to the previous parameter.

Rubrics for Project Presentation – Mini Project/IDP – PCIE 2 (40Marks)

CRITERIA	Excellent (8-10)	Good (4-7)	Average (1-3)	Poor (0)	Points
Final Design & interpretation of result	Design meets or exceeds desire–d objectives. Model is running successfully. Insightful, supported conclusion is achieved.	Design meets desired objectives. Model is made but not running properly. Sound conclusion reached based on achieved results.	Barely capable of achieving desired objectives. Model is not completed. Serious deficiencies in support for stated conclusion.	Not capable of achieving desired objectives. Model is not made. No or erroneous conclusion based on achieved results.	/10
	Excellent (8-10)	**Good (4-7)**	**Average (1-3)**	**Poor (0)**	**Points**
Technical Knowledge as par to inter-discipline	Explanation by all group members indicate a clear and accurate understanding of technical principles for model making	Explanation by all group members indicate somewhat accurate understanding of technical principles for model making	Explanation by most of members indicate somewhat understanding of technical principles for model making	Explanation by most of members doesn't indicate understanding of technical principles for model making	/10
	Excellent (8-10)	**Good (4-7)**	**Average (1-3)**	**Poor (0)**	**Points**
Communication, Elocution & Appearance	-communicates with excellent clarity and always uses scientific terminology	-communicates with good clarity and often uses scientific terminology	-communicates with some clarity and sometimes uses scientific terminology	-communication is poor with nil use of scientific terminology	/10
	-uses fluent speech and feels self-confident & relaxed	-voice is clear & pronounces most words correctly and feels little nervous	-voice is clear & pronounces incorrect terms and feels somewhat nervous	-voice is not clear	
	-completely formal & well dressed	-somewhat formal dressing. (no proper grooming)	-partially formal dressing. (no grooming & no formal shoes)	-no formal dressing	
	Excellent (8-10)	**Good (4-7)**	**Average (1-3)**	**Poor (0)**	**Points**
Responses to questions	Answers were well developed and displayed in depth understanding	Answers were good and showed good understanding.	Answers were partially complete but lacked depth of understanding.	No questions were responded.	/10
				Total	**/40**

Fig. 3 Rubrics for Assessment of PCIE-2 for mini-project

Now for the second stage of the task completed by the group of students, they will be assessed by the above-shown rubrics. The parameters over which they were accessed are discussed here in brief:

1. Final design & Interpretation of result: As it will be the near end of the semester and groups will be ready with the final design with some conclusive results that how the project will work and produce the results as concerned with all members of the group.
2. Technical knowledge as par to inter-discipline: Now as the title described, it is to be checked that how students gained knowledge of own discipline and others too by working in the same group [8].
3. Communication. Elocution and Appearance: One can consider this as an important parameter to represent themselves and also their project in an effective manner to the audience. More effective is the communication mode will be the way of expressing their work to their guide.
4. Response to questions: In the final stage, it is expected that members will be clear about the concept and the probable conclusion to be made with the help of their project and hence each member must be able to reply to the asked questions [8].

3. Different stages of progress

As this course was new to students and for the institute too, so there was a core team of faculties was formulated from the departments of mechanical engineering, computer engineering, electrical engineering and electronics & communication engineering. Main objectives of the teams are;

1. Notify students and guides about the ongoing activities of the course & semester.
2. Help students to form groups to fetch different members from different branches.
3. Help all groups to identify and understand problem statement of the project.
4. After mere finalization of the project title, all groups are assigned the faculty guides as per the area of the expertise. Probably after this process, the title may get change after discussion between students & guide.
5. Coordinate all viva-voices at scheduled weeks of the academic calendar.

The first two weeks are very troubled as a grouping of the students is a major task, as students of concern branch are not familiarized with other students hence the faculties play a vital role in making them understand the concept of project and grouping which helps them in identifying members of the group for their project work. Post finalizing the group and topic now comes the role of the guide where the title may get change as per the relevance and practicality of the project is concerned.

In the semester, it is understood that students had to work on the project and to teach other regular subjects which is hard to manage them as well it is a hurdle for faculties too. So periodically meditation/mentoring are organized for the students which help them to stay focused throughout the semester. All students might not excel well in the assigned work so it is a core responsibility of the allocated guide to help them achieve their goals.

Two weeks prior to practical internal evaluation, the rubrics, schedule & venue is shared with the students. During each assessment, they are instructed to present their progress report by a power point presentation and a detailed report, so as the guide and the department will be very aware of the group's progress in the project [9]. Laboratory assistants play a vital role in the support for the students, like any software/hardware help, requirements of mechanical/electrical tools, electronic components etc.

Without the unparalleled support of the project guide, the group won't be able to reach their destination. And hence every week, all groups are instructed to meet their respective guides to discuss the difficulties and other issue related to the project for which the guide will be able to mentor and help them in a proper manner [10].

Fig. 4 Meditation for the students by one of our faculty

The most talked issue was the finance to be applied for the project because few students across all the branches were not able to help monetary and in that case, the department came up with the financial support so that the project is not stopped in the between [11].

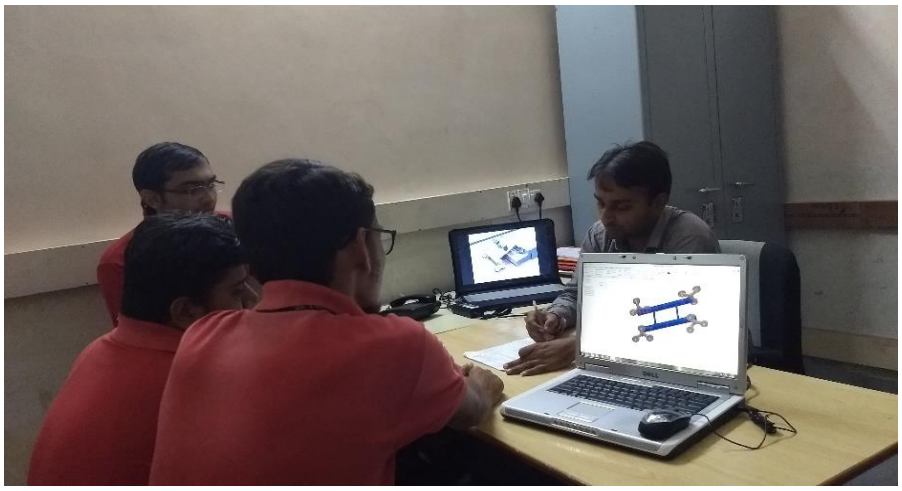

Fig. 5 Interaction between the guide and the group members

So finally, 18 groups were made and 15 guides are assigned different groups, each guide assigned minimum 2 groups. Regular reporting by the students was done under the supervision of all guides. In the initial phase of presentation, few groups were not clear about their title because which there was a delay in their progress which gradually was solved because of constant support of the guide [12]. Notable projects were Car parking system (students of mechanical & electrical engineering), E-scooter (students of electrical, mechanical & computer engineering), Bicycle operated clothes drier (students of computer & mechanical engineering) & Stair climbing robot (students of mechanical & computer engineering).

4. Result Analysis

In this paper, it was showcased that how the student groups were formed across the department of mechanical, computer, electrical and electronics & communication engineering.

Proper mentoring and guidance was provided by the assigned guides and other faculty members hence, there was a smooth flow of the project work execution.

Fig. 6 Students during the presentation of internal evaluation

Let us observe the summarized structure of novel assessment technique deployed the multi-disciplinary student projects.

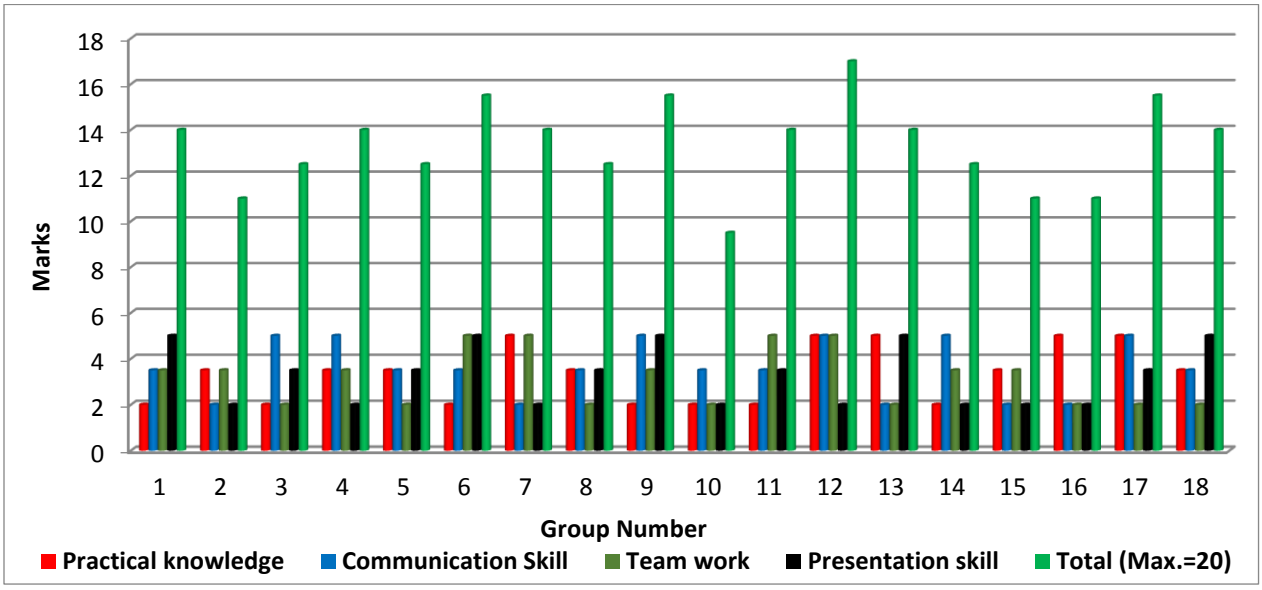

Fig. 7 Marks of student's groups as per Rubrics (PCIE1+2)

In above graph, each criterion of the rubrics is considered for the assessment of student's groups. The total marks of each groups are depend on the group performance, not individual performance. Here, each student is also assessed for their individual marks.

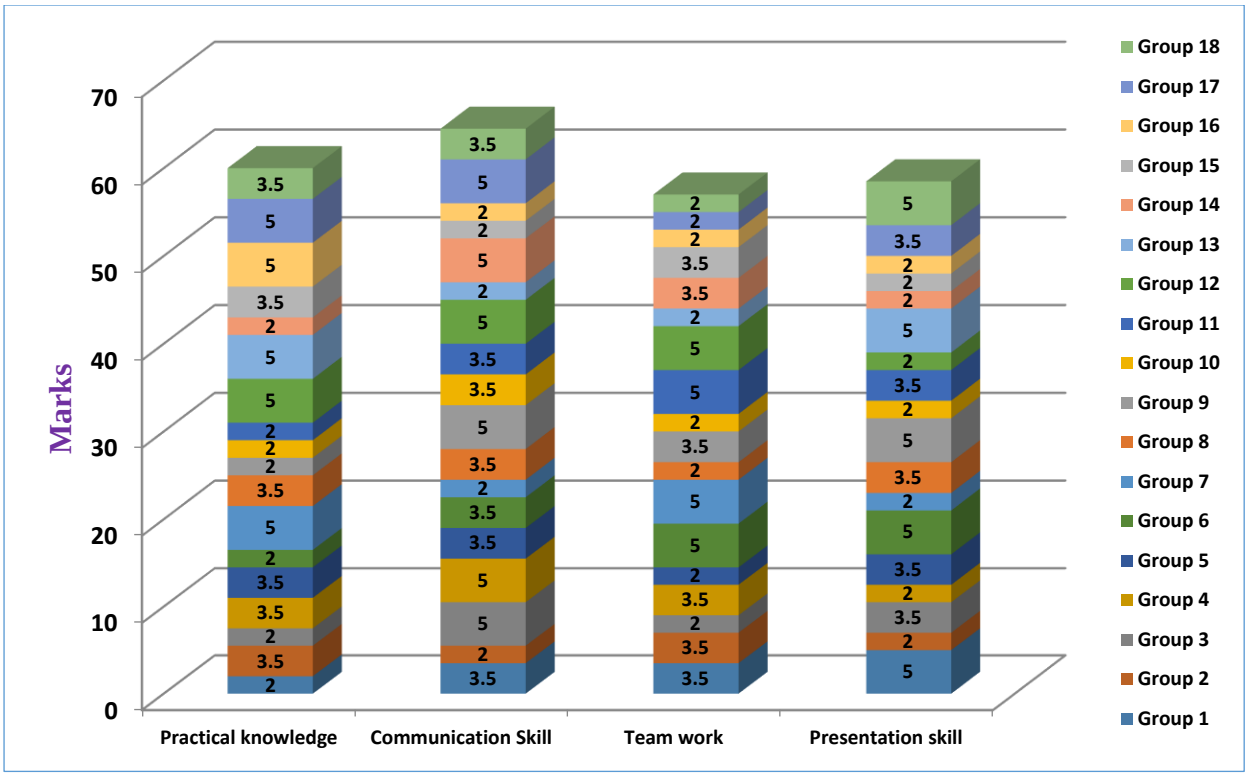

Fig. 8 Rubrics criteria based marks for the groups (PCIE1+2)

Now see (fig. 8) the individual criteria of the rubrics for various groups. The rubric parameters are included PCIE 1 and PCIE 2 exam.

In the assessment, marks are based on poor, average, good and excellent categories. Here poor means zero and excellent means five marks. Poor preference of the groups having one more opportunity to improve their performance within the predefine time line.

After doing vigilant assessment of each group and the study of assessment following outcomes are originated.

1. As this was the start of the final year, so the students were able to improve their communication & presentation skills at the final phase of the project work.
2. Students were unsure of speaking in front of the audience which was very well improved in the second phase of the project work.
3. A healthy competition was observed among the groups which were appreciated by the HODs & the faculty members.
4. In subsequent to the next semester which is of Industrial Training, enough amounts of observations, presentation & communication skills were needed for which guide's support becomes a major boost for them.
5. Since the project models were of the prototype, so the students were motivated to carry forward this project to next level with some research & analysis in the concerned field of engineering.

5. Conclusion

After applied novel assessment technique the students were able to improved their communication skill, presentation skill & practical knowledge at the final phase of the project work. The students were acquired healthy competition among the groups. The students are more prepared for next semester which is of industrial training. The project models were of the prototype, so the students were motivated to carry forward this project to next level with some research & analysis in the concerned area of engineering.

Author Bio

I am Dr. Riaz K. Israni, an accomplished academic and researcher, currently serving as an Assistant Professor in the School of Engineering at RK University, Rajkot, India. I hold a Ph.D. in Electrical Engineering, which I completed at RK University, Rajkot, where I have also been actively engaged in the academic and research community. With over 11 years of extensive teaching experience, I have had the privilege of shaping and mentoring countless students, guiding them through the complexities of electrical engineering. In addition to my academic role, I bring with me 3 years of valuable industrial experience, which has provided me with a well-rounded perspective on the practical applications of engineering principles.

Throughout my career, I have been deeply committed to research and scholarship. I have published 13 research and review papers in prestigious international journals, contributing to the global body of knowledge in electrical engineering. Additionally, I have had the opportunity to present 12 research and review papers at various international conferences, where I have engaged with fellow researchers and professionals, sharing insights and advancing discussions in the field.

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