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# Comparison of Peer Grades and Instructor Grades for Problem Solving Activity

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**Abstract :** Assessment, grading, evaluation is one of the trending topic in engineering these days and another trending topic is problem solving skills development in engineering students. In engineering course like Electromagnetic Theory and Transmission Line (EMTL) which is more inclined towards mathematics it requires more problem solving skills in students. While developing this kind of skills it is difficult for instructor to facilitate and grade students and see whether the students have followed the problem solving process or not. Considering this two issue, this paper compares the Peer grades and Instructor evaluated grades and describes problem solving activity. The method used for implementing Peer Evaluation activity is Enquiry Based Learning. This activity of problem solving was implemented on N=28 students for the course EMTL in Hyderabad Institute of Technology And Management. The results obtained were significantly positive when comparison is done between Peer and Instructor Evaluated grades and problem solving activity was successfully implemented. Limitations of the implementations are discussed in the paper.

**Keywords:** Peer evaluation, cognitive skills, engineering students, enquiry, analysis, conceptual.

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## 1. Introduction

It is commonly seen that assessment is one of the biggest challenge now a days specially for medium and large class size, it requires a lot of labour and time to do the evaluation by instructor manually. A lot of research has been done in the area of problem solving (higher order cognitive skill).Digital homework manager where also used to grade student problem which focuses only on the end result but not the process followed by the student while solving problem(Sarah et all,2015).In one of the research author uses detailed rubric to grade the students according to process followed was also requires more time consuming and labour. Researchers also say that Problem Solving skills among the students is somewhat less when compared to theoretical concepts. But we have to acknowledge all the students that if problems are solved on concepts, it is very easy for them to apply those concepts in real-world applications.

## 2. Background

Research that has been done mainly focuses on the peer evaluations and the problem solving.Most of the researcher described that problem solving is one of the complex task for students as well as for faculties also The main purpose was to check whether peer evaluation works in class room environment and also check how it correlates with instructor grading. “Already in Wendy Adams research the peer evaluation was done to improve the student's

performance and then instructor can grade the modified work of the students after peer evaluation and feedback which can yield better result than direct evaluation and there are tools existing which corrects the problem based on end result but not focus the process followed by students".

Similar studies were done on the basis of Relative Validity Of Peer and Self-Evaluations in Self-Directed Interdependent Work Teams. They finally concluded that Peer evaluations had greater validity than self-evaluations. They demonstrated this on the Seniors from the disciplines of geology and petroleum engineering at the Colorado School of Mines(N=49), (Robert S. Thompson in 2001).

Previously researchers concluded that instructors had to make grading more effective by propagating the teacher's assessments through the network of peer assessments so to maintain a progressively improved evaluations of the peer assessments precision. In this paper we have described the present state of implementation and experimentation of Open Answer, a web-system providing support to teachers in the definition, administration, and evaluation of open-ended questionnaires. (Andrea Sterbini, Marco Temperini) Researchers described about the study on how peer review instruments based on existing e-learning tools can affect the quality of peer review process and how this type of tools can benefit the reviewers. So finally they concluded that combination of the features of both tools should make a better peer assessment tool. Further investigation is required on how these tools can be improved or combined to organize a complex peer assessment marking criteria properly and to benefit the reviewers better (Xiaosong Li in 2015)

Some of the papers based on weighted arithmetic mean, is proposed to evaluate performance test scripts automatically. The score through our approach can indicate the correctness of scripts. Students are prone to make mistakes in rendezvous points and parameterization. And it can be used in online performance testing courses and replace calibrated peer review. (Ruijing Gao1, 2, China in 2016). According to previous researchers implementation of activity such as Peer assessment will likely be utilized in future versions of the course. Additionally, comparisons of instructor and student assessments should be made to assess the reliability and validity of the peer assessments and actual student learning gains should be attempted to further elucidate the effectiveness of the technique in attaining course objectives. (N=620,were divided into 17 sections)(Dr. Angela Thompson P.E., University of Louisville in 2014). Based on Research took placed we investigated the peer-review outputs with the aim to find out the ways of replacing the teacher's evaluation with students reviews. (Veronika Bejdov a, ZuzanaKubincov´a and Martin Homola Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava, Slovakia Email: {bejdova,kubincova,homola}@fmph.uniba.sk in 2014).

In this paper, we are trying to implement the activity called Peer Evaluation for Problem Solving among the students. While conducting we will get the peer grades as well as instructor grades, we will analysis all the data and finally we Comparing the Peer grades and Instructor grades.

Research Questions

Research Question 1: How are peer evaluated grades and instructor evaluated grades of the students are related?

Hypothesis 1: It was expected that there would be a positive relationship between peer evaluated grades and Instructor evaluated grades.

Research Question 2: Are there any correlation among the parameters of the processing steps of the problem solving rubric?

Hypothesis 2: It was expected that there would be gender differences in the level of attendance and motivational behaviours.

## 3. Methods

A. Participants

This study was conducted on students completing, Course= "Electromagnetic Theory and Transmission Line",

Student = (N=28; males=18; females=10) of second year Electronics and Communication Engineering (ECE) at Hyderabad Institute of Technology and Management.

B. Instrumentation

Two questions were adopted from the text book of the course for the topic Force due to Point charges.

General Problem solving steps and its rubric was adapted from an online resource uploaded by Professor Dedra Demaree from Oregon State University

C. Procedure

Students first practice solving problem using the problem solving steps for three sessions and in the fourth session test was conducted based on peer evaluation.

Test was designed using the framework of inquiry based learning where one student was solver and other was inquirer in each team (total 14 teams). In the first round the solver solved the problem and the inquirer graded him(peer evaluation). In the second round the role was reversed and again same process repeated.

Instructor also did the grading again after the test to carry out the analysis.

The problem solving activities are conducted in class on each bench there were two student made to sit together and was given the evaluation rubric and the instructor explained the rubrics of evaluation and its parameters o students and how grade their peers. There were 14 teams.

In the each pair of two students one was problem solver and other one inquirer for first round and second round vice versa.

Problem solver will be shared only question and need to solve the problem.

Inquirer in the each groups will ask questions related to problem indirectly and support the problem solver to solve the problem if they are stuck as they have the complete solution with them and at the same time evaluate the solver whether he is following the process or not and grade accordingly.

In the second round the roles changes and another problem has to be solved by the new problem solver who was inquirer in the first round and the same process repeat.

Fig 1 shows that students are engaged in Problem Solving and taking active participation where Fig 2 gives a brief clarity on problem based concepts while solving and Fig 3 shows that students involved in the activity in the presence of Faculty.

**Fig. 1 Students evolved in Problem Solving activity.**

**Fig. 2 Peer evaluation is being done among the students.**

**Fig.3 Faculty facilitating students while solving problems in the class.**

D. Statistical Analyses

The statistical analyses on the dataset were performed using Libreoffice Calc(Excel).

The statistical procedures included Pearson's correlations between the variables were administered to the dataset to compare the peer evaluated grades and instructor evaluated grades and also check the relation between the processing steps of the problem solving rubrics considered in this study.

## 4. Results

The Table 1 gives the brief description about Correlation between Peer Evaluations and Instructor Evaluation grades. These grades gives a clarity about the result of similar category evaluators whose outcome is 1 always and dissimilar category evaluators got an outcome of 0.85**.

**Table 1. Correlation between Peer evaluations and Instructor Evaluation grades**

| Parameter | Peer Evaluated grades | Instructor Evaluated grades |
|---|---|---|
| Peer Evaluated grades | 1 | 0.85** |
| Instructor Evaluated grades | 0.85** | 1 |
| **.Significant at 0.01 level | | |

**Table 2. Correlation among the parameters**

| Parameter | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1.Read and translate | 1 | 0.23 | 0.40** | -0.04 | -0.15 | -0.19 |
| 2.State applicable laws | 0.23 | 1 | 0.19 | 0.56** | 0.17 | 0.08 |
| 3.Represent physically | 0.40** | 0.19 | 1 | 0.20 | 0.10 | 0.11 |
| 4.Represents the laws mathematically | 1 | 0.58** | 0.20 | 1 | 0.35 | 0.40** |
| 5.Work through Mathematics | -0.15 | 0.17 | 0.10 | 0.35 | 1 | 0.74** |
| 6.Evaluate result | -0.19 | 0.08 | 0.11 | 0.40 | 0.74** | 1 |
| **.Significant at the 0.05 level | | | | | | |

Table 2 gives us the brief description of Correlation among the parameters of the processing steps of problem solving rubric. Here we got know about the parameters such as Read and translate, state applicable laws, Represent physically, Represent the law mathematically, Work through mathematics, Evaluate results where this table also gives the outcome 1 at similar parameter and at dissimilar combinations there was an other outcomes.

## 5. Discussion

The results showed that there was a significant positive relationship between Peer Evaluated grades and instructor evaluated grades.

In addition, there were significant positive relationship found between the following

- Step1(Read & Translate the statement) & Step3(Represent Physically
- Step2(State applicable Laws & concept) & Step 4(Represent the Law mathematically)
- Step 5 (Work through mathematics) & Step 6 (Evaluate the result)

Considering the positive relationship between the parameters mentioned above, the current results, are consistent with the hypothesis, reveal that when students Read and translate the problem statement properly they also tend to represent the given information physically (in the form of diagram, flowchart), it is also found that if the student states the applicable law correctly they can also Represent the law mathematically. The students who correctly work through mathematics can also evaluate the results properly. Students following the process is also monitored using peer evaluation which cant be monitored evenly by instructor all for medium and large size classes.

Compare to the work of previous research as

mentioned in (Sarah et al, 2015)about the more Labor required for assessment .It is also found that the Labor and time has got reduced as the peer evaluation helps the instructor free from grading by evaluating it at the time of the session itself.

Comparing with previous studies from(Veronika Bejdova,2014)we got a clarity that students are peer reviewers which is a positive thing and therefore Peer evaluation activity is been conducted.

## 6. Limitation & Recommendations

The study is based on a single college sample and from a single course. This study if done for different course and institution can give broad results which can be generalised

Peer Evaluation done by students need to again cross checked by the instructor to see whether there is any difference in the grades and grading done by students as the student can also evaluate casually, also consider their friend giving more marks or reducing marks because of enmity, these personal factors are not considered in this study. Automatic grading using some tool to be designed which improves accuracy of grading and also monitor the steps followed by students for solving problems.

Some students don't want to follow the process and want to do problem using shortcuts but they ended up with improper results and stuck at different points.

In the problem solving rubric the values assigned to each parameter is not uniform which has made the analysis very challenging to do the correlation between different grades. The parameter state applicable law and also evaluate the results was also not address by students by writing as they mentioned it orally to their peers so it was difficult to cross check for instructor until something is written on the paper.

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