Peer Evaluation System

M. Tech Stage1 Project Report

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Abstract

Now a days online education program and distance learning program are promoted. Thus, it becomes necessary to maintain the quality of teaching and learning of students. As a part of learning, students should be evaluated well, so that they can understand further improvements if any, which is necessary. As the number of students increases for a course, it becomes hectic and difficult for the instructor to evaluate them in a given time schedule [7]. Here comes the concept of peer evaluation, where we are using peers as a students as well as teachers for the same course. Peer evaluation is basically a self regulatory body, where each member of this body, plays a role of teacher as well as student.
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Chapter 1

Introduction

This chapter gives insight of what peer evaluation is and some other available evaluation systems. Here some common benefits and drawbacks of each system are discussed.

1.1 Peer Evaluation

Peer evaluation is a type of crowd-sourcing, where resources are selected from an open network rather than a traditional one. So peer evaluation is considered to be an evaluation among peers, no need of instructor or a traditional evaluation system. Here, a peer plays a role of student as well as teacher which helps him in:

- Better understanding of same topic while evaluating others work.
- Motivation towards performing better.
- Possibility of improvements in evaluation technique.

1.2 Types of Evaluation System

This section discusses about different types of evaluation systems where, each have its own style of evaluation.
1.2.1 Expert Evaluation

It is traditional way of evaluation system, where a course instructor evaluates each student and gives them marks or grade.

- **Advantages**
  - There exist an environment of belief amongst students related with marks or grade they received.
  - Seriousness towards any feedback or comment given by teacher.
  - Belief in the accuracy of evaluation system.

- **Disadvantages**
  - Not applicable for large evaluation system.
  - If tutor allows group learning, then final grade is same to a group irrespective of hard work put in by a student in a group [9].

1.2.2 Self Evaluation

A student performs critical analysis of his own work and gives marks.

- **Advantages**
  - A notion of self directed learning arises.
  - Over-marking is never done.

- **Disadvantages**
  - Under-marking is done by most of the students.
  - Inconsistency between level of questions and level of understanding.

1.2.3 Peer Evaluation

The work is reviewed and evaluated by people of similar status [1].

- **Advantages**
  - Evaluation is completed in time.
– A proper understanding of problem is understood.
– In group learning, minimal injustice among group members is shown regarding marks or grades.

**Disadvantages**
– To control biasing, which is over-marking to friends and under-marking to enemies.
– A notion of ignorance towards feedback and comment given by peers.
– Disbelief on accuracy of system.
– Disbelief on accuracy of evaluator’s judgment.

### 1.2.4 Auto Evaluation

To assign marks or grade based on auto checking of assignments.

**Advantages**
– No discrimination among students.
– More efficient in terms of time.

**Disadvantages**
– Ineffective in terms of checking only some keywords, format and structure.
– In a group work, equal grading is given to all the team members.

### 1.3 Procedure for Implementing Peer Evaluation

#### 1.3.1 Group Formation

The idea is that we should have ‘$N$’ number of groups, if we want to have peer evaluation system, where each student or peer is evaluated by ‘$N$’. So among ‘$M$’ students, we have to divide them in ‘$N$’ groups, where each group have $\lfloor \frac{M}{N} \rfloor$ students. So here a question comes what should be the criterion for being in a particular group or how different groups are differentiated. There could be different ways for group formation.
Random

In such method we put ‘M’ students among ‘N’ groups i.e for 1000 students, and 4 groups, put 250 students in each group, without any criterion for selecting a student for a group.

Initial Quiz

- In the first case, instructor takes a initial quiz and each student is evaluated by random peers and finally average of all the marks given by peers to a student will be his/her final marks or criterion for dividing them in groups. Now we will put all student in decreasing order of their marks and divide them in ‘N’ groups.

- In second case, if it is feasible each student is evaluated by instructor and then, again on the marks basis we will sort them in decreasing order and divide them in N groups.

- To improve the quality of peer evaluation system, we can repeat this group formation procedure after each peer evaluation, using data of previous evaluation.

1.3.2 Peer Evaluation

Now for each student select one random peer from each group and make sure that this peer should not be the same, whom you are evaluating. Thus some constraints are necessary :

- While selecting an evaluator for a student from each group, the evaluator and the student who is going to be evaluated should not be same i.e a student should not evaluate himself.

- A student should evaluate as many peers as the number of groups.

- One important point, some common guidelines and solutions for each assignment should be shared among all students, so as to help them in evaluating others.
1.3.3 Normalization

It would be the case that some students are not serious, they could be over generous, very strict, etc. Then in all such cases we need to normalize the marks given to students. So some common terms need to be learn,

- **Individual Effort Rating** : It is the sum of marks received by a student i.e.
  \[ IER = m_1 + m_2 + m_3, \]
  where \( m_1, m_2, m_3 \) are marks given to a student in an evaluation system of 3 groups.

- **Average Effort Rating** : We define average effort as.
  \[
  AER = \frac{\sum_{i=1}^{M} IER}{M}
  \]

- **Individual Weighing Factor** : It is defined as.
  \[ IWF = \frac{IER}{AER} \]

- **Bias Factor** : For each student bias factor is
  \[ Bias_i = \frac{M_i}{AER}, \]
  where \( M_i \) is marks given by student \( i = 1, 2, 3, \ldots, M \).
  If bias factor is in the range [0.98, 1.02] then there is no need for normalization, otherwise,
  Normalization = \( \frac{1}{Bias_i} \), where \( i = (1, 2, 3, \ldots, M) \), should be multiplied in each marks given by student \( i \).

- This process is repeated for every change.

In the chapter 2 deep analysis of peer evaluation is done in different aspects and in the chapter 3 some effective ways are described for evaluation. Moreover in the chapter 4 some common problems are discussed and their solutions, conclusion, and future work part are described in further chapter.
Chapter 2

Literature Survey

This chapter described more about practical implementation of peer evaluation. A case study and some comparison level study is also described further in this chapter.

2.1 Learning

In traditional method, a group based learning is resisted by instructor, as it

- Unfairly increases the grade of peer students.
- Good students in a team don’t get expected grade as per their hard work.

But, if we change this traditional evaluation method by an effective method, it will ensure that each student is accountable not only for group, but also for the instructor. Then, team based learning can be made effective. This comprehensive, feedback and grading system will have :

- Individual Effort Component
- Team Effort Component
- Peer Evaluation Component

Team based learning course are derived from 4 separate but interrelated terms :
• Individual preparation
• Collective preparation
• Applicability of knowledge in solving different problems.
• Enhancing new skills from existing one.

Now we will see how peer evaluation and assessment helps in team based learning:

• It improves individual performances in a team. More over, it also improves interpersonal and team based skills of individual that helps in their future success.

• It provides summative(outcome) data to instructor that helps for grading each students in group.

• It increases students accountability and instructional guidelines.

While performing peer assessment and evaluation in team based learning (TBL). When a student becomes assessor, it shows a more thoughtful understanding of this process. A peer’s feedback or evaluation seems to be significant motivator for a student, than the traditional instructor’s feedback. Using peer self and co-assessment process in learning helps in:

• Increasing confidence in individual’s performance.

• To take more control in their learning through development of critical analysis of others.

• To scrutinize the purpose and objective of a course.

Peer evaluation is necessary in team based learning, because peers are the ones in the group who have enough information about each other. It will improve in the following:

• Personal motivation.

• Quality of work.

• Compare individual work’s with others.

• Evaluation is inferred with the relationship fellow learner.
2.1.1 Guidelines for Implementing Peer Assessment and Evaluation [2]

Setting Expectation

Dimensions and assessment criterion are cooperative, flexible, dependability, attendance, respect for team members, communication, initiator, leadership, and decision making. When students are involved in designing and assessment procedure:

- Peer evaluation must be given weightage.
- Instructor must be comfortable with administration of instrument.
- Instructor should address any concern of disbelief and fairness.

Using Periodic Formative Assessment

We should have periodic assessment that will help individual to enhance their skill and be beneficial in final grade, by improving their negative skill and enhancing positive skill as given by peers in the form of feedback. The number of assignment should be moderate, neither too much nor too less.

Preparing Learner for Feedback

Giving constructive and appropriate feedback is a skill that takes time to learn. So before implementing peer evaluations, students should be given a demo of evaluation process. It could be an instructor reviewing his own published paper and criticizing weaknesses.

Anonymous Versus Owned Peer Assessment and Evaluation

If there is anonymity among peers then:

- Peers will be more honest.
- Peers may provide harshed criticizing while evaluating to other peers.

So the main factor is that, if feedback has been done correctly, it makes no sense to implement anonymity or ownership in peer evaluation.
Customizing the Process

Depending on the environment of an institution, peer evaluation system’s frequency changes and also the objectivity of it. There are 5 different approaches:

- Each peer is given fix number of points that he has to distribute to his team members provided there is a minimum and maximum marks limit that he can give to his team members.
- Each peer is given fix number of points that he has to distribute and there is no minimum or maximum marks limit.
- It is based on comprehensive feedback section which capture cooperative skills, self directed learning, interpersonal skill and qualitative questions.
- To design and construct procedure that will collect quantitative and qualitative data from students.
- It uses qualitative data, comments given and received, makes a difference for students who fall on a borderline.

2.1.2 Discussion

Here we need to discuss few points:

- Education skill is not initiative. So peers should be given demonstration on how to evaluate and give feedback.
- To enhance the skill for giving more appropriate and constructive feedback, practice is necessary.
- This system is best suited in an environment having culture of professionalism and minimal amount of competition and mistrust.
- Qualitative assessment should be done.
- Students are more comfortable with qualitative feedback than quantitative feedback.
2.2 A Case Study

It is an exploratory investigation of secondary school writing class in Hong Kong [14, 15], where learner is the one who is a reader as well as teacher. Collaborative construction of knowledge in classroom are viable option for precluding learners from re-conceptualizing their traditional roles.

2.2.1 Goal of Study

In this, we will discuss about the objective and goals of this study which are:

- Did the evaluation sheets and revision indicate that there is any textual change from peer evaluation.
- Did this peer evaluation help the student in becoming aware reader, evaluator.

Few things or area were main field to collect data:

- Is peer evaluation system is useful or not?
- Belief on the accuracy of peer's judgment.
- How to evaluate or guidelines.
- Perception about real reader.
- Concern.

We have done peer evaluation and self evaluation then only those things which were not common in these(peer, self) evaluation were again reviewed and revised. There was proper monitoring of revision phase to see this incorporation of revised feedback. None of the peers believe that peer evaluation helped them in becoming aware reader, evaluator. There were so many concerns listed out:

- Real reader is teacher or examiner not peer.
- Can not evaluate without prior knowledge of field.
- Seriousness among evaluators.
Belief on peer’s accuracy.

These were the final conclusion point:

- Students have negative comment on the perceived usefulness of peer evaluation system.
- Students do not agree with changing the role of teacher.
- According to students a teacher is one who have deep knowledge of the subject.
- Deep knowledge about the topic as he is evaluating others. But in peer evaluation there is nothing like that.
- The notion of classroom reading should be change.

## 2.3 Comparison Level Study

### 2.3.1 Peer, Self and Tutor Assessment

Problem based learning include self, peer and tutor evaluation to assess skill like self directed learning, group and communication [4, 12, 13]. Tutor and peer evaluation has one common attribute that is to judge other’s work. Students should develop the ability to reflect on their own strengths and weaknesses as self directed learning.

There was poor correlation between self and tutor, i.e students were constantly under-marking their own performance. Moreover, there were some moderate correlation between tutor and peer assessment, but here, students were over-marking to their friends and students having skeptical view towards peer assessment. It seems from the study that students were more accurate in judging their peer’s performances than their own performance. So self assessment is not an accurate measure.

Students should be skilled, active, and self directed learner inspite of passive recipients of information. This would help in development of problem based learning. Four basic conditions are necessary:

- A well structured knowledge base.
- Active learner.
• Collaborative learning.
• Internal motivation.

Assessment protocol include:

• Self assessment
• Tutor assessment
• Peer assessment

to include self directed learning, group cooperation and communication.

In problem based learning there was strong and weak correlation between tutor and peer assessment. In non problem based learning there was moderate correlation among them. Self and peer assessment are related in such a way that a student evaluates his/her peers. Then, while evaluating his/her own submission he/she can compare it with other evaluated submissions. It is the case that:

• Lower performing students always over-mark their peers.
• Young or highly capable person under-mark their performances in self assessment.
• There was minimal gender effect in self as well as peer assessment.

To make more accurate result, we need to involve both self and peer that is co-assessment. Two approaches are:

• **Qualitative**: To collect student’s perception towards these assessment processes.
• **Quantitative**: To assess the accuracy of students as assessor with tutor scores.
• Demographic factor and self-efficacy which is a student’s perception of the ability to carry the task accurately so as to affect students scoring.

Qualitative and quantitative data were collected using two instruments:

• Peer assessment instrument.
• Self efficacy.
2.3.2 Peer Assessment Instrument

- Responsibility and Respect.
- Information Processing.
- Communication.
- Critical Analysis.
- Self Awareness.
Chapter 3

Effective Peer Evaluation

In this chapter some effective ways [5] that are already implemented are described to have a gist of what consequences were seen when applied practically. In it we have also included steps to follow implementation of system.

3.1 Web Based Evaluation System [11, 10, 8]

Peer assessment is “To assess the value, quality, level, worth, successfulness of the product of learning of other’s work of similar status”. It helps in improvement of student’s cognitive skills, evaluation skills which are reflected in his subsequent work. A web based system contains:

- Automatic result.
- Strict guidelines.
- Tutor support.

There are three main activities those are:

- **Group Discussion**: To better understand assignment and improve interpersonal skills.
- **Marking**: Compare own work with peer’s work and then enhance in self evaluation skills.
- **Feedback**: Provide feedback to others, for the sake of further improvements. The purpose of such things are:
– Self Learning.
– To learn accuracy in judging other’s work.
– To provide the effect of peer assessment.

There has been so many paper based on peer assessment which lacks in:

• Anonymity.
• No award for marking.
• Inconsistency in assessment.

3.1.1 System

It depends on four steps which are:

• Design, in this step there comes few more things which are:
  – Process
  – Anonymity
  – Group Discussion
  – Mark Scheme
  – Marking criterion and guidelines

• Software Development
• Deployment
• Monitoring

Process

Generally, students are not serious while evaluating others or they don’t evaluate. Thus, one stage that is added is “QualityMarkingFeedback”. So it becomes necessary to give feedback and follow the process seriously. It should be two way, i.e the relation of evaluator’s feedback is decided by student whose evaluation is done by evaluator. As we can see in Figure 3.1.
Anonymity

There should be anonymity in web based peer evaluation to avoid biasing, because it would be the case that student will give over marks to their friends and under marks to their enemy.

Group Discussion

There will be a group discussion among students to make sure whether they are marking right or not and moreover they will also come to know about what strategy others are following.

Marking Scheme

Total marks are divided in 50% given by automatic result, rest 50% is divided into 30% peer score and 20% is gained by feedback. As we can see in Figure 3.2.

Marking Criterion

There should be some marking criterion or guidelines which will help students to evaluate others and self evaluation. As we can see in Figure 3.3.
3.1.2 Software Development

Students submit their assignments in the department’s online submission system, and then the web based system will handle these submissions to divide students to make sure who is evaluating to whom.

3.1.3 Deployment

The objective of peer assessment and evaluation should be clear to everyone. It should not be misunderstood. The purpose of the system is not just

<table>
<thead>
<tr>
<th></th>
<th>Comments are</th>
<th>unhelpful</th>
<th>○○○○○</th>
<th>helpful</th>
<th>○○○○○</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>The code are indented</td>
<td>inconsistently</td>
<td>○○○○○</td>
<td>consistently</td>
<td>○○○○○</td>
</tr>
<tr>
<td>3</td>
<td>Variable/function names are</td>
<td>inappropriate</td>
<td>○○○○○</td>
<td>appropriate</td>
<td>○○○○○</td>
</tr>
<tr>
<td>4</td>
<td>The code handles errors</td>
<td>inappropriate</td>
<td>○○○○○</td>
<td>appropriate</td>
<td>○○○○○</td>
</tr>
<tr>
<td>5</td>
<td>The program finishes with an appropriate exit status</td>
<td>never</td>
<td>○○○○○</td>
<td>always</td>
<td>○○○○○</td>
</tr>
<tr>
<td>6</td>
<td>The utilities have been selected</td>
<td>inappropriate</td>
<td>○○○○○</td>
<td>appropriate</td>
<td>○○○○○</td>
</tr>
<tr>
<td>7</td>
<td>The program is structured</td>
<td>poorly</td>
<td>○○○○○</td>
<td>well</td>
<td>○○○○○</td>
</tr>
<tr>
<td>8</td>
<td>Overall, following what the program is doing is</td>
<td>hard</td>
<td>○○○○○</td>
<td>Easy</td>
<td>○○○○○</td>
</tr>
</tbody>
</table>

Figure 3.3: Marking Criterion
assessment but learning things also. Few thing should be followed:

- Why and how marks are awarded.
- Feedback should be appreciated.
- There should be an environment of belief among students in terms of feedback as well as marks awarded.
- During marking process, tutor should be available to assess any inconsistency.
- The whole peer assessment process should be fair.

3.1.4 Monitoring

Problems that arises:

- Some students don’t evaluate.
- Some will cheat.

So, there should be proper monitoring of process to ensure minimal inconsistency in the whole process.

3.1.5 Discussion

It needs practice to become a tutor or evaluator. It is not a single day job, no matter how much guidelines are provided. Also there are some deeper issues that need to be discussed, i.e some students think that they are not qualified to be marker, only tutor lecturer is an expert marker. Some students did not believe on peer assessment systems, as they think peer would not work fairly. The novelty of system is:

- The awarding of marks for the student’s marking itself.
- Facility for anonymous marking.
3.2 Electronic Peer Review and Evaluation System

In this a peer review and peer grading system based on web is used and described [6, 16]. So first thing that comes into mind is that why web based system is used. So there are few points that need to be discussed for web based system design which are:

- Now a days many of us are familiar of web interface, thus, it becomes easy to use a system that itself uses something that we are familiar with.
- Web based system can accept any format for submission i.e picture, video, html, text, diagrams etc.
- Now a days web skills are heavily used, thus making us aware of something which are emerging in coming days.
- It could be used in distance education also.
- By using this system, we can produce some web based resources i.e research papers, good quality assignments etc.

3.2.1 Peer Grading System

It is a Java based web portal which initially used common gateway interface based application. Now it is using Servlet based application. Few points to be noticed are:

- For each submission there will be 3 to 4 reviewers.
- Final marks or grade will be average of all grades given by reviewers.
- For each grade comments should also be given as feedback for some improvements.
- In this the instructor can configure the system to allow other reviewers to see other reviewer’s grade.
- Only an unique id will be shown to control biasing.

There are mainly six phases in peer grader system which are mentioned below
3.2.2 Phases

Sign up phase: All the students are given an unique id and password to avail the facility of peer grader system.

Submit phase: In this phase, by using login id and password a student can submit, as well as review other’s submission. It is not necessary to submit the same type of submission as there will be different type of submission options. A student can choose accordingly and submit.

Initial feedback: In this, a student is given 3 to 7 days for giving comments on others submission. Moreover, he can even grade the submission but it is recommended to comment, so that some modification can be done on submission.

Grading phase: In a given time duration usually 3 to 7 days submissions are revised, reviewed, and graded by reviewers, and final grade is freezed.

Review of review phase: For each student we have a list of reviewers along with given grades by reviewers and then final grade is average of grades a student have got. One more thing 25% of grade is based on reviewing to make reviewing process sincere.

Web publishing: For each type of submission the highest reviewed student’s work is published to make coming students to be aware of previous researches done.

3.2.3 Where Could be Used

- In all computer science programming courses this system can be implemented.
- For creating research lectures material, could be used.
- If we have online link, then students can annotate with proper link wherever required.
- Review of papers from literature can be done using this system.
• Design review of other student’s semester projects.

**Pitfalls**

• Student don’t submit .html file inspite of the warning given.

• It must be told from where to start, because it supports arbitrary types of web pages.

• Use of absolute path names will help, only if something is stored globally not in local machine.

• Names in submissions should not be mentioned.

• If a student drops a course before review starts, then some students will have less number of reviews and for some will have to review less number of students.

• Mapping between reviewers and submitter should be done carefully so that a student may not have to review his own work.

• Late submissions handling problem.

• There should be negotiation between author and reviewers to synchronize time duration.
Chapter 4

Peer Evaluation Problems

To ensure the high standards in science and research, peer review is necessary [3]. It is like embodiments of mutual control. Peer review is better than any form of self regulation in higher education and research. Due to following points, critics oppose peer review:

- Quality of peer review is affected by personal attribute of authors, reviewers and applicants.
- Reviewers have poor reliability on peer review process.
- Peer review lacks predictive validity.

A peer review system should be reliable, fair and valid. Thus in a scientific contribution, paper is published with help of reviewers, they should believe on peer review process and on its reliability and validity. A peer review based study programs goes through 3 stages which are:

- Internal Evaluation
- External Evaluation
- Implementation of reviewer’s recommendations.

4.1 Reliability (Agreement among Reviewers)

When a scientific contribution meets a scientific standards and is treated as an advancement in scientific contributions. Such contributions are rated high when there is a high agreement among reviewers.
4.1.1 Limitations

- Experts engaged in debate for study of reviewer’s agreement for a study.
- Only reviewers final recommendation is taken.
- Limited document for agreement and disagreement of reviewers.

In, not all study or scientific contribution, reviewer’s disagreement is taken in negative sense but in few cases it was taken into positive way for opposition. Moreover, it is fact that too much agreement is something like work has not been done well. Even the case comes when two reviewers of same topic has no critical point common in their reviews.

4.2 Fairness of Peer Evaluation Process

The basis for giving feedback or reviewing of any scientific contribution should be the objectivity of that work not the attribute of authors, applicants and personal things. So there is a fear of lack of objectivity in peer review process. In many surveys, authors did not agree with the objectivity of reviewers or the feedback they had given. Biasing factor while reviewing:

- Nationality
- Gender
- Area of research

Two major problems while finding biasing in peer review process:

- It is inconsistent, this means for the same biasing factor take e.g. gender, has two different result, one supporting biasing factor and other opposing this factor.

- It is impossible to perform peer review process unambiguously. We can’t remove all doubts from peer review process because it is done by human beings and it will reflect their interest, support, oppose in this review.
4.3 Predictive Validity of Peer Evaluation Process

While predicting the validity of peer review process, it can be cross checked by two phenomenon

- For a grant application for funding and acceptance of manuscript, should be based on the number of citations as it is accepted and followed at international level.

- Grants and manuscript that are accepted have a number of citations. So it shows a co-relation between citation and quality of research work that has been done.

As an experiment, we have taken a list of papers that were rejected from a journal. So those papers were accepted in a journal of having lower impact factor than the journal from where these papers were rejected. In addition the number of citations for rejected papers that were later accepted in lower impact factor journal were also half of citations in comparison with higher journal. After a number of agreement this result comes out:

- Article published by successful and non-successful applicants were cited considerably more often than the “average” publications.

- Excellent research performance can be expected more from successful than non-successful applicants.

4.4 Related Issues

This section will contain some common existing problems that we need to address in time otherwise it would create major issues while implementing in real world.

- Group Formation.

- Validation of group formation.

- Anonymity groups as well as in the groups.

- Maintaining the attendance while evaluating.
• Verification and validation of evaluation system.

• Maintaining the standard in between questions and student’s ability.
Chapter 5

Conclusion and Future Work

As we have mentioned related problems with peer evaluation system, i.e reliability, anonymity, fairness. To make system more effective we should have some hierarchical control over peer evaluation system, which is not possible if system is totally online or web based. There should be some physical intervention to cross check the effectiveness of system. In Blended MOOCS(massive open online courses) model there is such type of evaluation system where only lecture part is cover online while evaluation process has to pass through a series of process involving physical, face to face evaluation also.

Thus as a future work this peer evaluation system could be used in Blended MOOCS model for evaluation purpose.
References


