A Weighting Factor as A Tool To Adjust the Student's Grades: Web Development Project as A Case Study

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Abstract: Group project is one of the most common assessment methods used in New Zealand Private Tertiary Establishments (PTEs). Group work is considered as a purposeful and valued learning approach as it enriches the experiential learning of group dynamic. However, for the possibility of student satisfaction and positive learning outcomes with group activities to be significantly improved certain points need to be achieved; effective group project processes are utilised, clear assessment instructions are developed and communicated, and valid and fair grading is employed for the project processes. On the other hand, if students cannot see the point of group projects or they are unsure of what is expected of them or think the assessment methods are invalid or the grading system is unfair; the educational benefits are reduced and tensions can emerge. In fact, the way in which students engage in a group project is mainly determined by the way in which they are to be assessed. For example, since not all group members have the same contribution, the students feel that giving the same mark to all members is unfair. As a result, some tertiary educators use a strategy called 'peer and self-assessment' as a method of determining how group marks are to be distributed among individuals [1]. This paper provides an approach to calculate the peer review points and adjust the individual grades. The proposed approach is called the weighting factor (Wf) that represents how much the contribution percentage is for each member of the group

Index Terms: Group project, Self and peer review, student assessment, Teamwork.

I. INTRODUCTION

Group projects as an assessment strategy are in demand in education. Group work is also one of the most real-world practice ways of ensuring that students develop suitable skills for long-life learning (teamwork, leadership, project management skills, and communication skills). This has largely been in reaction to industry demands for more flexible workers [2]. Group work supports in the development of social membership in a mass education environment which can be isolating and confusing for students [3]. Nevertheless, 'Free riders' problem can arise if the group members do not contribute equally to the process and required outcome [4].

When the students are working in small teams and to provide an authentic experience, means that each team originates a different project. Several challenges are presents particularly when the projects themselves are significantly different. Such as performing a fair and accurate assessment of individual student contributions to the work produced by a team. Another challenge is assessing the teamwork itself.

Various forms and broad application of peer review have been developed. For over three decades, peer review has been used to calculate and review a varied range of student work including written assignments, oral presentations, artwork and architectural designs, programming and code reviews, musical performances, as well as being used in various teamwork and capstone projects [5].

Web development projects are 8 weeks' course work undertaken by the first-year students in the three years' bachelor of creative software at AMES/Animation College. The aim of the course is to provide the students with experience developing a creative website project in a small team of 3 or 4 students. The projects ideas proposed by students themselves. The student final grade is based on contribution percentage of teamwork and individual tasks.

The contribution percentage can produce from self and peer review feedback of the team members using the weighting factor (W*f*). This practice can estimate how much each student contribute to the project. It is a critical challenge to estimate the grade of each member if there no formula determines how to use the points given by team members and make them effective.

This paper describes the self and peer review form used in web development projects, the criteria used to evaluate the tasks of the project. The paper also discusses the weighting factor (W*f*) which is the formula developed to use for producing the contribution percentage of each team member. Also, some case studies from the class are described here.

II. LITERATURE REVIEW

Depends on the assessment objective the assessor might want to assess the final product such as the proposal, the design and presentation, or assess the group process like contribution to group's meetings and meeting the deadline. Also, the research body shows a lot of approaches are available for assessing the team members of a group project. The assessor may choose to assign a shared mark of the group work to each member, individual marks centered on product tasks, or on a combination of product, group process and individual contribution. Besides, some assessment may contain self and/or peer review as well as review by teaching staff. However, each option has advantage and disadvantage [6] [8] [18]. According to [7],

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The self-review assessment is defined as a formative assessment where the students can evaluate and reflect the quality of their work and their learning.

They can also identify strengths and weaknesses in their work by judging the degree to which they reflect clearly identified criteria. On the other side, the peer review is defined as a formative assessment where the students can reflect the quality of other team members' work. Briefly, In the group project assessment, Self-assessment means the students assessing their own work and peer-assessment means the students assessing the work of others within a group [8][18].

However, Self and peer review assessment, have been used to solve various problems. It is introduced the benefits of enhancing student learning, developing their understanding and providing a suitable solution for awarding individual grads in the group projects assessment [9]. Also, it has been employed to address 'Free rider' problem [10]. [11] has recognised the problem of 'free-riders' within group work. Therefore, the educators need to consider the impact of this problem on student's attitude to group work. The need for the peer review is also required to develop the skills of the evaluation, feedback and review the value of contribution to the teamwork effort. These skills are significant for every professional to have and should be able to use for different purposes [14].

The group work assessment is understood by the students as unfair if there is an equal grade for unequal contributions [12]. These Undesirable experiences can cause the students become sadness and dissatisfied with group work [7]. Therefore, the challenge for educators is to develop new approaches to assessment that are standard and accepted by students as considering equality in group work assessment [13].

There are a number of peer review tools available in the literature using different approaches to report self and other team members' contributions. One approach is using prescribed list of terms such as "excellent, "very good", "satisfactory" and so on to describe the overall performance of team members. While a numerical rating to assess team members' behavior is used by another approach. Keeping record or writing a report about their contribution to either the project as whole or their individual work products is also widely used as peer review tool [16][17].

Many approaches have been used to produce the individual grades based on the self and peer review assessment in a group project. On example is the groups are advised to start the meeting with a round of statements by the team members about their respective contributions to the project. Then and by discussion and negotiation, the group agrees at an allocation of the marks that all team members are satisfied. The outcomes are then presented to the Project Manager, an educator, for approval. The individual marks are accepted, once the agreement on the mark allocation is confirmed [14].

However, another example is using different formulas by assigning a weight to peer review assessment, educator assessment, the product process and the individual tasks. The individual grade for each member is produced by combining them [18].

III. COURSE DESCRIPTION

Web development project is 8 weeks course work offered to the first year students of bachelor of creative software programme. This programme has been introduced at Animation College NZ/ AMES IT Academy. This project work worths 50% of the final grade of the course : CS103 the web and mobile app development.

The aim of that project is to allow the students to demonstrate their understanding of basic project management skills, fundamentals of UX and web design and development, by applying skills and concepts introduced in CS101 (User Experience of web and App design) and CS102 (Web and App Development); and a holistic understanding of the entire product lifecycle. The project also helps students to communicate, collaborate and problem solve effectively in teams.

The following are the Learning Outcomes (LO) that the students have to meet based on the given tasks in projects:

L01. Explore creative and critical thinking to develop proposals in response to briefs.

L02. Identify the different roles and stages within the web and mobile app development projects.

L03. Demonstrate social sensitivity through working effectively in development teams.

L04. Review learning, practices and strategies as an individual and team member.

The students work on the project in teams/groups of three to four members. The students arrange themselves into groups, each group has to decide on a name for the group and the idea of a project. The idea of the project is to design and develop a website for a small business of students' choice. Each group member has to participate in the design and the development of the website. However, each group member has to be assigned one of the following three roles: project manager, design leader and development leader.

The project tasks include the project proposal, the project report and the final presentation. The project proposal is divided into two subtasks the written report and oral presentation. The project report is divided into three subtasks including design, implementation and testing. The report has to include the risk register, Gantt chart and meeting minutes. All these tasks are teamwork. The project assessment focus on process rather than the quality of the product. The project also has another individual task which is the blog which worth 15% of the final grade project.

Self and peer review is another task the students have to do when they complete all the tasks. It worth zero marks. The goal of this task is to get the feedback from students about the contribution of the team members. The outcome of the task is weighting factor (W*f*) which used to amend the student's mark according to the contribution to the team.

IV. SELF AND PEER REVIEW TASK

At the end of the projects work, each team member has to fill out a form to review the other three team members of the project.

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The form contains the list of key group work traits and each member will rate the other members against each task. The rating scale as following starting from (1 to 5):

1. Did not contribute in this way
2. Willing but not very successful
3. Average
4. Above average
5. Outstanding

Fig1 and Fig2 show respectively the form design introduced to the students. The form includes the tasks of the project which each member has to scale the contribution to the project tasks.

Bachelor of Creative Software

CS103

Game App Development Studio

(Integrated Studio 1) Part-1

Group and Self-Assessment Tool

In the form you have to provide your feedback of the contribution of each member. For each item, rate each person and yourself using the 5point scale given. Please think hard and honestly about each of the tasks and how you and each group member performed. It is not necessary that everyone get the highest score on each item. Different people will have different strengths and different contributions.

Please do your evaluations independently– do not share or discuss your scoring or come to a decision based on a group opinion. I want a rating from each of you, based on your perceptions and experiences.

Submit one form for each group member, including yourself, with your name and your group members' name on each form.

Group Name:
Group Members:

Student Name (Self): **ID:**

M1 Name: **ID:**
M2 Name: **ID:**
M3 Name: **ID:**

Figure (1)

The key work of the project	Self	M1	M2	M3
1. Proposal (presentation)				
2. Proposal (writtenreport)				
3. Website Design (research, Prototype …user testing)				
4. Design Report				
5. Implementation (coding)				
6. Testing				
7. Testing report				
8. Meeting Minutes				
9. Other documents				
10. Website Demo				
11. Support other team members				
Scoring For each category, award yourself and each member of your team a score using this scale.	1- Did not contribute in this way 2- Willing but not very successful 3- Average 4- Above average 5- Outstanding			

Figure (2)

The overall weighting factor (Wf) will be generated based on the points given by the other team members. The formula of weighting factor (Wf) is as follows:

$$Wf_{Member} = \frac{(\sum_1^m \sum_1^n p)_{Member}}{Max_{Total}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Wf: Weighting factor
M: The number of team members
N: The number of tasks in the project
P: The points are given to the member for a task

The final grade for each student will calculate by using this formula:

$$FinalGrade_{Mmber} = Wf_{Member} \times GroupWork \quad \ldots\ldots\ldots(2)$$

V. CASE STUDIES

A total of 23 students' (participants) from year one in BCS were selected in peer review feedback activities. The paper presents some case studies from the class. The result of three groups is studied using the new approach. The point is to see how effective this approach to assess the individual contribution in the group project. The students'' names used in the case studies are fictitious.

A. Case study (Group 1)

The group of four students (Bob, Nancy, Hugo and Andrew) has been selected as an example. The students have been completed the project after 8 weeks' work. They are given 63 marks out of 80 for the project work. The students have been given the peer review forms to assess their team members. Andrew of the team members did not contribute to the project work. He didn't attend the classes. He also didn't communicate with them. It's clear, he has no contribution to the project. Moreover, he didn't fill the peer review form.

The excel sheet is used to calculate the weight factor for each student, see figure 3. The data in the given forms are entered into the excel sheet.

Calculate Weighting Factor

Group Name Group 1

First member review	Criteria	Assignor "Bob"	Assignor "Nancy"	Assignor "Hugo"	Assignor "Andrew"	Grand total	Weighting Factor
Assignee "Bob"	1. Proposal (presentation)	5	5	5		156	1.00
	2. Proposal (written report)	5	5	5			
	3. Website Design	5	3	5			
	4. Design Report	5	3	5			
	5. Implementation (coding)	5	3	5			
	6. Testing	5	4	5			
	7. Testing report	5	4	5			
	8. Meeting Minutes	5	4	5			
	9. Other documents	5	5	5			
	10. Website Demo	5	5	5			
	11. Support other team members	5	5	5			
Second member review	**Criteria**	**Assignor "Bob"**	**Assignor "Nancy"**	**Assignor "Hugo"**	**Assignor "Andrew"**	**Grand total**	**Weighting Factor**
Assignee "Nancy"	1. Proposal (presentation)	5	4	5		155	0.99
	2. Proposal (written report)	5	4	5			
	3. Website Design	5	4	5			
	4. Design Report	5	3	5			
	5. Implementation (coding)	5	5	5			
	6. Testing	5	5	5			
	7. Testing report	5	3	5			
	8. Meeting Minutes	5	4	5			
	9. Other documents	5	3	5			
	10. Website Demo	5	5	5			
	11. Support other team members	5	5	5			
Third member review	**Criteria**	**Assignor "Bob"**	**Assignor "Nancy"**	**Assignor "Hugo"**	**Assignor "Andrew"**	**Grand total**	**Weighting Factor**
Assignee "Hugo"	1. Proposal (presentation)	5	4	5		154	0.99
	2. Proposal (written report)	5	3	5			
	3. Website Design	5	4	5			
	4. Design Report	5	5	5			
	5. Implementation (coding)	5	3	5			
	6. Testing	5	5	5			
	7. Testing report	5	3	5			
	8. Meeting Minutes	5	4	5			
	9. Other documents	5	4	5			
	10. Website Demo	5	4	5			
	11. Support other team members	5	5	5			
Forth Member Review	**Criteria**	**Assignor "Bob"**	**Assignor "Nancy"**	**Assignor "Hugo"**	**Assignor "Andrew"**	**Grand total**	**Weighting Factor**
Assignee "Andrew"	1. Proposal (presentation)		1			11	0.07
	2. Proposal (written report)		1				
	3. Website Design		1				
	4. Design Report		1				
	5. Implementation (coding)		1				
	6. Testing		1				
	7. Testing report		1				
	8. Meeting Minutes		1				
	9. Other documents		1				
	10. Website Demo		1				
	11. Support other team members		1				
				Max Grand Total=		156	

Figure (3)

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Figure 4 shows the points assigned to Bob by other members. Bob has reviewed himself by giving himself the highest score which is 5 in each task.

First member review	Criteria	Assignor "Bob"	Assignor "Nancy"	Assignor "Hugo"	Assignor "Andrew"	Grand total	Weighting Factor
Assignee "Bob"	1. Proposal (presentation)	5	5	5		156	
	2. Proposal (written report)	5	5	5			
	3. Website Design	5	3	5			
	4. Design Report	5	3	5			
	5. Implementation (coding)	5	3	5			
	6. Testing	5	4	5			
	7. Testing report	5	4	5			
	8. Meeting Minutes	5	4	5			
	9. Other documents	5	5	5			
	10. Website Demo	5	5	5			
	11. Support other team members	5	5	5			1.00

Figure (4)

Hugo also gave the same points to Bob. Nancy has seen Bob is outstanding in first two tasks and the last three tasks but other tasks are between average and over average. Andrew did not share in this activity at all. So the total for all these points for Bob is 156. The same procedure should be completed for other team members.

Figure 5 presents the points assigned to Nancy by other team members. Obviously, Bob and Hugo assigned the same points that they gave to Bob. However, Nancy has a different view from Bob about himself. So the Total of all the points for Nancy is 155.

Second member review	Criteria	Assignor "Bob"	Assignor "Nancy"	Assignor "Hugo"	Assignor "Andrew"	Grand total	Weighting Factor
Assignee "Nancy"	1. Proposal (presentation)	5	4	5		155	
	2. Proposal (written report)	5	4	5			
	3. Website Design	5	4	5			
	4. Design Report	5	3	5			
	5. Implementation (coding)	5	5	5			
	6. Testing	5	5	5			
	7. Testing report	5	3	5			
	8. Meeting Minutes	5	4	5			
	9. Other documents	5	3	5			
	10. Website Demo	5	5	5			
	11. Support other team members	5	5	5			0.99

Figure (5)

Following the same procedure for the third member Hugo. Bob and Hugo have given the heights scores for all the team members except Andrew. However, Nancy assigned different points to different tasks between average and over the average and outstanding. She got the total 154 according to equation 1, see figure 6.

Third member review	Criteria	Assignor "Bob"	Assignor "Nancy"	Assignor "Hugo"	Assignor "Andrew"	Grand total	Weighting Factor
Assignee "Hugo"	1. Proposal (presentation)	5	4	5		154	
	2. Proposal (written report)	5	3	5			
	3. Website Design	5	4	5			
	4. Design Report	5	5	5			
	5. Implementation (coding)	5	3	5			
	6. Testing	5	5	5			
	7. Testing report	5	3	5			
	8. Meeting Minutes	5	4	5			
	9. Other documents	5	4	5			
	10. Website Demo	5	4	5			
	11. Support other team members	5	5	5			0.99

Figure (6)

Regarding the fourth member Andrew. He didn't contribute at all to the project work. As a result, he has to get nothing from the project work mark. Practically his weighting factor should be result zero. Nevertheless, as figure 7 shows he got the less points than Nancy. On the other side Bob and Hugo have been decided to do not assign any points to him as they see he has done nothing. So the total points for him is 11.

Forth Member Review	Criteria	Assignor "Bob"	Assignor "Nancy"	Assignor "Hugo"	Assignor "Andrew"	Grand total	Weighting Factor
Assignee "Andrew "	1. Proposal (presentation)		1			11	
	2. Proposal (written report)		1				
	3. Website Design		1				
	4. Design Report		1				
	5. Implementation (coding)		1				
	6. Testing		1				
	7. Testing report		1				
	8. Meeting Minutes		1				
	9. Other documents		1				
	10. Website Demo		1				
	11. Support other team members		1				0.07

Figure (7)

Now each member has the total points as following Bob=156, Nancy= 155, Hugo=154 and Andrew=11.

According to the weighting factor formula the maximum total points has to be looked at is 156 in this case. Therefore, the weighting factor and the marks of project work for each member will be:

$$Wf_{Bob} = \frac{156}{156} \Rightarrow 1$$, And final mark is 64.5 × 1 = 64.5

$$Wf_{Nancy} = \frac{155}{156} \Rightarrow 0.99$$, The final mark is 64.5 × 0.99= 63.85

$$Wf_{Hugo} = \frac{154}{156} \Rightarrow 0.99$$, The final mark is 64.5 × 0.99 = 63.85

$$Wf_{Andrew} = \frac{11}{156} \Rightarrow 0.07$$, The final mark is 64.5 × 0.07=4.5

B. Case study (Group 2)

Another group has been studied in this paper. Group of (Todd, John, Zac, Jack) has got 63.5 marks for project work. The weighting factors for the group members were calculated as following: Todd has got a good review from his team members as Figure 8 shows with total points is 178. Todd has reviewed himself with high score comparing to his group members.

First member review	Criteria	Assignor Todd	Assignor John	Assignor Zac	Assignor Jack	Grand total	Weighting Factor
Assignee Todd	1. Proposal (presentation)	5	3	3	4	178	
	2. Proposal (written report)	4	4	4	4		
	3. Website Design	5	4	4	4		
	4. Design Report	5	3	4	5		
	5. Implementation (coding)	5	3	3	4		
	6. Testing	5	4	3	4		
	7. Testing report	5	4	3	4		
	8. Meeting Minutes	5	4	3	5		
	9. Other documents	3	3	4	4		
	10. Website Demo	5	4	3	4		
	11. Support other team members	5	5	5	4		1.00

Figure (8)

John another team member has got the total points of 142. Figure 9 describes the review of John. Obviously,

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Todd gave the lowest point to John where the others gave him mostly 3 or 4.

second member review	Criteria	Assignor Todd	Assignor John	Assignor Zac	Assignor Jack	Grand total	Weighting Factor
Assignee John	1. Proposal (presentation)	5	3	3	4	142	
	2. Proposal (written report)	4	4	4	4		
	3. Website Design	1	2	4	4		
	4. Design Report	1	3	4	4		
	5. Implementation (coding)	1	3	3	5		
	6. Testing	1	4	3	5		
	7. Testing report	1	4	3	4		
	8. Meeting Minutes	1	4	3	4		
	9. Other documents	1	3	4	4		
	10. Website Demo	1	4	3	4		
	11. Support other team members	1	5	5	4		0.80

Figure (9)

Figure 10 presents the case of the third member Zac. He is got 146. However, Todd also assigned the lowest points to Zac. Clearly, Todd was unhappy with John and Zac. But the others gave points mostly 4 and 3 to Zac.

third member review	Criteria	Assignor Todd	Assignor John	Assignor Zac	Assignor Jack	Grand total	Weighting Factor
Assignee Zac	1. Proposal (presentation)	5	3	3	4	146	
	2. Proposal (written report)	3	3	4	4		
	3. Website Design	1	3	4	4		
	4. Design Report	3	3	4	4		
	5. Implementation (coding)	2	3	3	4		
	6. Testing	1	4	3	4		
	7. Testing report	1	4	3	4		
	8. Meeting Minutes	1	4	3	4		
	9. Other documents	3	3	4	4		
	10. Website Demo	2	4	3	4		
	11. Support other team members	2	5	5	4		0.82

Figure (10)

The last case in Figure 11 which is Jack's review. Jack has got the lowest points among the team members. He got 107 points.

forth member review	Criteria	Assignor Todd	Assignor John	Assignor Zac	Assignor Jack	Grand total	Weighting Factor
Assignee Jack	1. Proposal (presentation)	5	1	3	4	107	
	2. Proposal (written report)	4	2	4	4		
	3. Website Design	1	2	4	2		
	4. Design Report	2	2	4	2		
	5. Implementation (coding)	1	2	3	1		
	6. Testing	1	2	3	1		
	7. Testing report	1	2	3	2		
	8. Meeting Minutes	1	2	3	4		
	9. Other documents	1	3	4	2		
	10. Website Demo	1	2	3	3		
	11. Support other team members	1	2	5	2		0.60

Figure (11)

By checking the total points for team members and according to the formula the maximum point is 178.

Todd = 178, John = 142, Zac=146 and Jack = 107. With following the formula to calculate the weighting factor for each member.

$$Wf_{Todd} = \frac{178}{178} \Rightarrow 1$$ The final mark is $63.5 \times 1 = 63.5$

$$Wf_{John} = \frac{142}{178} \Rightarrow 0.80$$ The final mark is $63.5 \times 0.80 = 50.08$

$$Wf_{Zac} = \frac{146}{178} \Rightarrow 0.82$$ The final mark is $63.5 \times 0.82 = 52.7$

$$Wf_{Jack} = \frac{107}{178} \Rightarrow 0.60$$ The final mark is $63.5 \times 0.60 = 38.1$

VI. DISCUSSION

The students in the class has been given a questionnaire to have their feedback about using the weighting factor in the group project work. The questions were as following (with scale responses strongly disagree, disagree, agree and strongly agree):

1. Do you think that the weighting factor is a good approach to assess the individual contribution?
2. Are you happy with your result?
3. Do you think your group feedback was fair?
4. What the steps you are going to take to get the highest score in the group?
5. Do you think to involve the lecturer feedback in weighting factor calculation will results a good weighting factor?
6. Any comments you want to add?

The responses show that most of participates are agree or strongly agree with using the Weighting Factor to amend the individual grade. A few of them have difficulty of understanding how they got their mark. Which shows the students need more practice on using this approach.

VII. CONCLUSION

The students need to improve their abilities to rate themself and their peers. Therefore, practice self and peer assessment many times have been suggested to improve them. The students cannot give a professional rate from the first time [15]. The students should be fully aware of the mechanism of weighting factor approach. The training and practice have to be given to the students before the project assessment commerce, so the students will think a twice when they give the rating.

The individual grades of group project work show the contribution of each team member to the group which is close to real contribution. In contrast, a few students have assigned themselves and other team members same score even they know they do not have the same contribution. Others do not like to show themselves in lowest scores. Nevertheless, the Weighting Factor (W*f*) proposed in this paper can give a kind of accurate grade.

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