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Introduction to WebPA

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Executive Summary

This document is an in-depth look at why WebPA should be used to help in the peer assessment of students, by students, for group working. Both the history and current development of the project, as well as the reasons why WebPA should be adopted are covered.

To help develop a better understanding of the WebPA system, a look at the different sections of the system are included. All of the areas than an academic would use are introduced and the terms and concepts used in the system are explained. The scoring algorithm is also broken down and explained for the current version of WebPA running at Loughborough. This has been included to try and help explain the full system and how it works.

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About WebPA

Current Developments

The latest version of WebPA has now been completed and is in use at Loughborough University. The system is available for use by any Loughborough University department, and is being supported and maintained by the Engineering Centre for Excellence in Teaching and Learning (engCETL).

In the summer of 2006, engCETL made a successful bid under JISC's e-Learning Capital Programme. This new two year project has received funding of £200,000, and will allow further development to the current system, and help provide the system as an application to other UK universities.

History

A small group of academics at Loughborough University have been using online peer assessment since 1998. The online peer assessment system (PASS) was created as a small-scale project for the Wolfson School of Mechanical and Manufacturing Engineering, based on an existing paper based system used by Peter Willmot.

Later, Teaching Quality Enhancement Fund (TQEF) money was used to rewrite the system based on tutors' feedback and the new system, renamed WebPA, was launched.

In 2004, Peter Willmot proposed a new Engineering Education Centre (now the engCETL) project to further improve the online system. This project has now culminated in the release of the new WebPA online system that is in use today.

Introduction

WebPA is an online peer assessment system, or more specifically, a peer-moderated marking system. It is designed for teams of students doing group-work, the outcome of which earns an overall group mark. Each student in a group grades their team-mates (and their own) performance. This grading is then used with the overall group mark to provide each student with an individual grade. The individual grade reflects the students contribution to the group.

The following is a very quick description of how the WebPA process works;

- you create a question set (form) and assessment criteria that your students will use to mark their team mates. Once created, a form can be re-used again and again,
- you create the groups you need, and assign students to them. If you want to assess your groups more than once, you can re-use the same groups,
- you create an assessment and schedule when it will run,
- the students peer-assess each other,
- from those scores, each student gets a weighting
e.g. 1.1,
- that weighting is multiplied by the group-mark to give the students actual mark e.g. $1.1 \times 80\% = 88\%$,
- you can also set how much of the group-mark is peer assessed. For example, you may want the peer-assessment to only apply to 50% of the group-mark, e.g. $(1.1 \times (50\% \text{ of } 80\%)) + (50\% \text{ of } 80\%) = 84\%$.

Some assessments may be formative, and there is always the possibility of disputes, so WebPA doesn't automatically put the final marks into a student's official record. That final step is left up to the individual academics.

Why use peer assessment?

There are several drivers for using peer assessment when reviewing group and team work activities.

- Assigning one mark to a group of students for a project is inherently unfair. Students commonly complain that their contributions are not being given the credit they deserve, and group members who didn't pull their weight receive the same marks as those who contributed far more.
- It allows academics to better grade a student's abilities against a range of key skills that will be expected to demonstrate as graduates, such as leadership, communication, report writing, etc.
- Peer review prompts students to reflect and assess their own abilities, as well of those of their team mates.

Why use WebPA?

For academics WebPA:

- is easy to setup, run and reuse computerised assessments,

- gives the ability to handle large class and group sizes, as well as any length of assessment form.
- calculates final grade automatically,
- the ability to change the way the scoring algorithm works and view the results immediately,
- provides improved accuracy of the assessment marking;
 - as there is a reduced risk of transcribing errors,
 - errors introduced when manipulating data in spreadsheets,

For students WebPA:

- provides assessments that can be taken at any time from any where,
- allows time to be taken to consider submissions, as well as the opportunity go back and alter the scores until satisfied,
- allows anonymous submissions.

Assessment Forms

What are assessment forms?

The forms are the basis of a peer assessment. They are the templates that contain all the questions and assessment criteria that the students will use to rate each other.

Below is an example of the types of making criteria you could set.

1. Contribution to Team Planning					
Score 1 : No participation					
Score 2 : Poor participation					
Score 3 : Reasonable participation					
Score 4 : Good Participation					
Score 5 : Full participation					
	1	2	3	4	5
Alice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bob	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Claire	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
David	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Elaine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 1 - Example of marking criteria

It is possible to create any number of forms, and once they are created all forms can be reused for any number of assessments. New forms can be generated that are based on an old form by copying an existing form and then altering the information.

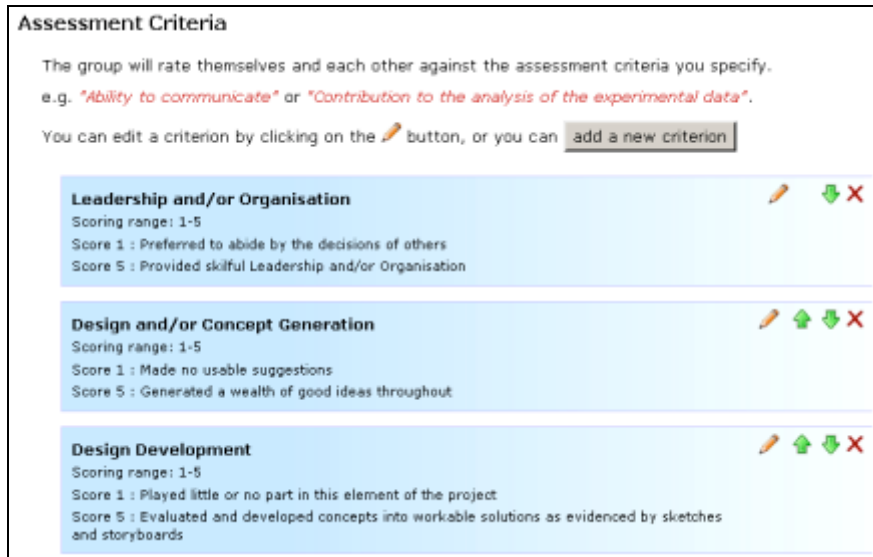


Figure 2 - Screen shot of the forms screen for WebPA

Groups

Groups are teams of students organised under one heading.

Why set up Groups?

Before setting up an assessment criteria all students should be allocated into groups. It is up to the academic how these groups are formed.



Figure 3 - Example screen shot of setting up groups in WebPA

Any number of groups can be created, and once created. It is possible to base new groups on existing groups and is done by cloning a group and then changing students in and out of the group as required.

What are Collections?

In WebPA, collections are used to help manage lots of groups at once. Each collection contains all the groups that will take part in an assessment. Each assessment can only run for one collection of groups.

Collections are created by setting up a name, then selecting the student information. Groups are then formed by associating students, as illustrated below. Typically, a collection of groups might be all students on a particular module.

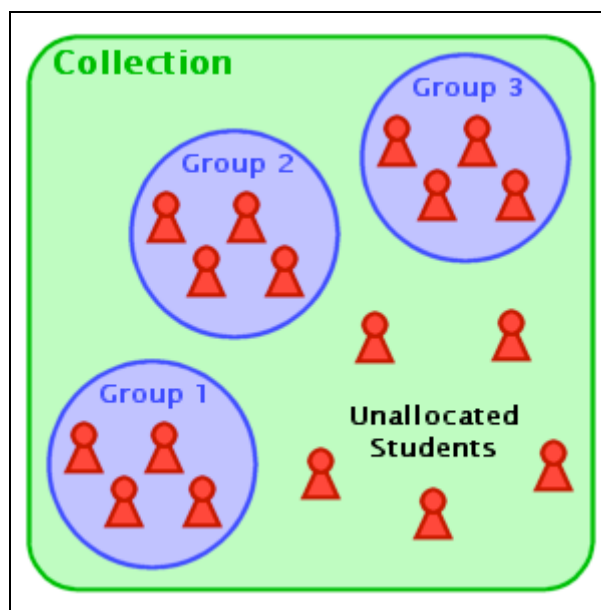


Figure 4 - Illustration of a collection

To recap:

- **Collection:** An organization of groups all collected under one heading. A collection can contain as many groups as wanted.
- **Groups:** A team of students who will be working together and peer-assessing each other. Groups can contain as many students required, although around 4-5 is considered the norm.
- **Unallocated Students:** Within a collection, students can only be a member of one group at a time. Students who have not yet been placed in a group are listed as unallocated.

Assessments

WebPA allows the creation, editing and scheduling of peer assessment sessions that can be run, how and when required.

To schedule an Assessment, a form must be selected, the collection of groups selected and then the time and dates for both the start and end of the assessment period are set.

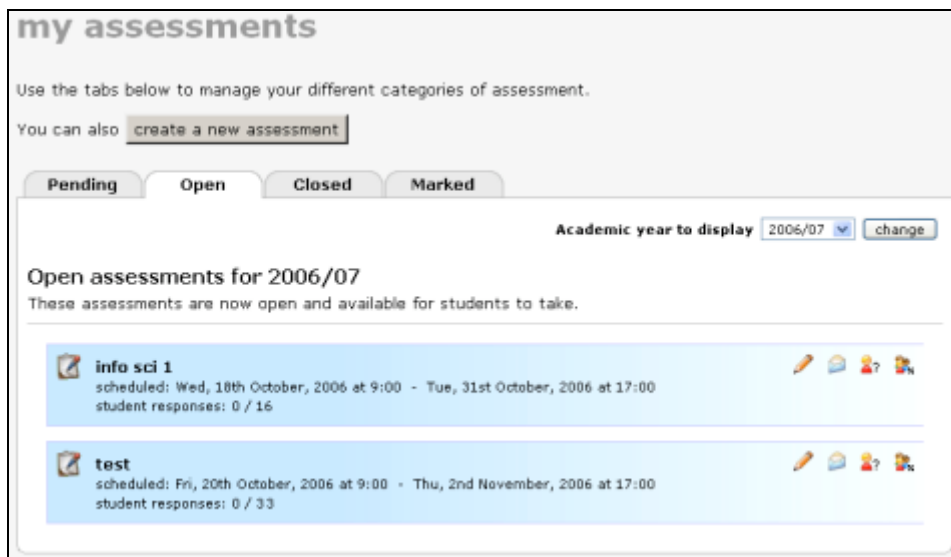


Figure 5 - Screen shot of the Assessments area of WebPA

Assessments are set-up with in WebPA so that the student can only take a defined assessment once. If the same assessment is to be run multiple times with the same collection of students then two separate assessments must be set up and scheduled. Within WebPA this is easy to achieve as the assessments are reusable as are the collections.

Students must submit marks for everyone in their team, including themselves. A student cannot submit any assessment unless they have assigned marks to everyone.

If a student does not take the assessment at all, it is possible to penalise them or not. WebPA allows the size of any penalty to be awarded when the mark sheet is created.

Brief Glossary of Assessment WebPA terms

- **Pending:** Assessments that have been written and scheduled for some point in the future.
- **Open:** Assessments that are currently available to students
- **Closed:** Previously available assessments that will not accept further student submissions, but no results have yet been generated from the data.
- **Marked:** Assessments where the deadline for student submissions has passed and the results from the data has been produced.

Assessment Reports

Assessment reports and statistics related to assessments which are complete are available through WebPA.

Each report shows the students marks and grades using the parameters outlined in the related mark sheet. WebPA allows any number of work sheets to be created, each with different parameters. This feature of WebPA allows the comparison and contrast of how algorithm can affects the final student grades.

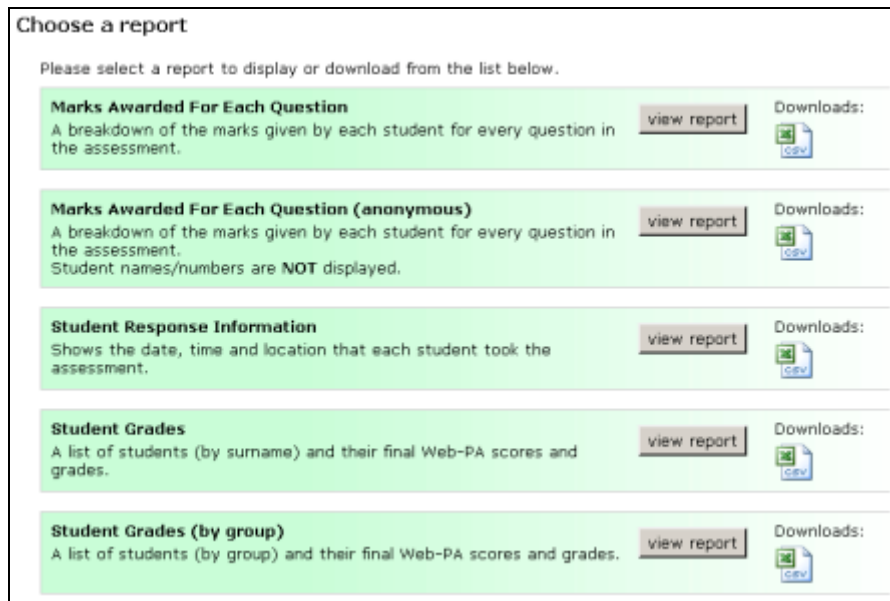


Figure 6 - Screen short of the reports screen from WebPA

If a overall mark received by each group in the collection is not entered then some of the reports are not available. WebPA's algorithm needs the group marks to be able to calculate the final student grades. Some of the reports, such as the marks awarded and the response information, can be viewed at any time as they do not require the algorithm to produce their results.

Scoring Algorithm

The following is a worked example of how WebPA would grade an assessment.

A Worked Example

This is a very simple example assessment, focussing on a single group, marking each group member against a single question.

For readability, most of the numbers used later, in this example, are rounded to 2 decimal places. The actual WebPA algorithm is more precise and provides a greater accuracy.

The Data

Performance in the group task

	Alice	Bob	Claire	David	Elaine
Alice	4	4	3	2	1
Bob	3	5	3	2	0
Claire	4	4	4	4	4
David	3	5	4	3	1
Elaine	-	-	-	-	-
Total Received	14	18	14	11	6

Figure 7 - Example of a peer marked criterion

In this example, the rows across are the marks given by each student, whereas the columns down shows the marks each student received. The marks received are totalled at the bottom.

A quick review of the scores shows that Bob performed the best, while Elaine has performed the worst. Also, Elaine didn't submit any marks for the peer assessment at all, as denoted by the dashes in her row.

Normalise the Scores Awarded by each Student

For each student, all the marks each student awarded to each other are added up (total up each row).

There was only one question in this example, so only one set of scores have to be added up. If there were more questions, the scores would be totalled for each question and then creating a total for the assessment.

Alice awarded: $4 + 4 + 3 + 2 + 1 = \mathbf{14}$ marks
Bob awarded: $3 + 5 + 3 + 2 + 0 = \mathbf{13}$ marks
Claire awarded: $4 + 4 + 4 + 4 + 4 = \mathbf{20}$ marks
David awarded: $3 + 5 + 4 + 3 + 1 = \mathbf{16}$ marks
Elaine awarded: $0 + 0 + 0 + 0 + 0 = \mathbf{0}$ marks

Figure 8 - How the marks are calculated

Once it is known how many marks each student is allocated, the scores that they gave can be awarded and the fractional score for each student can be calculated. In other words, every student in the group has an identical 'cake', but they can give different sized slices to each other (and themselves!).

Alice awarded a total of 14 marks (so her cake was split into 14 slices).

Alice gave herself 4 marks = $4 / 14 = 0.29$

Alice gave Bob 4 marks = $4 / 14 = 0.29$

Alice gave Claire 3 marks = $3 / 14 = 0.21$

Alice gave David 2 marks = $2 / 14 = 0.14$

Alice gave Elaine 1 marks = $1 / 14 = 0.07$

Figure 9 - How the fractional scores are calculated

These are the fractions awarded by Alice to each student. As a test, all the fractions can be added up and they should equal 1.

This process is repeated for every student.

Calculate the WebPA Score awarded to each Student

Before each students WebPA score is calculated, there's one more bit of information that is needed; how many students were in the group, and how many of them submitted marks.

In this case the group had 5 members, which means 5 cakes should be split between 5 members. Unfortunately, Elaine didn't submit any marks, so only 4 cakes are available!

To compensate, WebPA calculates a multiplication factor to bring the total number of cakes back up to 5. This value is identified as the "fudge factor".

5 (students in group) / 4 (students submitting) = **1.25** (our fudge factor)

Figure 10 - Calculation of the multiplications factor

At long last, the WebPA scores can be calculated. Taking Alice as an example, we add up all the fractional scores she was awarded. We calculated Alice's own fractions above, but the other students' fractions were produced in exactly the same way.

Alice gave herself **0.29** (as we saw above).

Bob gave Alice **0.23** (= $3 / 13$).

Claire gave Alice **0.20** (= $4 / 20$).

David gave Alice **0.19** (= $3 / 16$).

Elaine didn't submit, so she effectively gave **0.00**.

Figure 11 - Fractional scores awarded to the members of the group

If all the individual factors are added up, the WebPA score is calculated. For Alice:

Alice's WebPA score = $0.29 + 0.23 + 0.20 + 0.19 + 0.00 = \mathbf{0.91}$

Figure 12 - Alice's WebPA score calculation

If everyone had submitted the assessments, that would be fine, but remember we had one non-submission, so we have to bring in our fudge factor from earlier.

Alice's actual WebPA score = 0.91×1.25 (the fudge factor) = **1.14**

Figure 13 - Alice's actual WebPA score

If the same calculations are done for each of the other students, we find:

Bob's actual WebPA score = $1.18 \times 1.25 = \mathbf{1.47}$

Claire's actual WebPA score = $0.89 \times 1.25 = \mathbf{1.11}$

David's actual WebPA score = $0.68 \times 1.25 = \mathbf{0.85}$

Elaine's actual WebPA score = $0.33 \times 1.25 = \mathbf{0.41}$

Figure 14 - Each of the groups WebPA score

As a quick check, adding up all the WebPA scores for every student, it should equal the number of students in the group. Adding up the scores gives 4.98, which allowing for rounding errors (we're using 2 decimal places in this example) is **5**, the total number of students assigned to the group.

Calculate the Student's Final Grade

Now the WebPA score have been worked out, it is easily to calculate a student's final grade using the overall group mark.

Let's assume we've awarded this group's work 80%. Ordinarily, this may have given everyone in the group 80%, but now using the WebPA scores to give either proportionally higher or lower marks according to the students actual performance.

Alice's Grade = $1.14 \times 80 = \mathbf{91.2\%}$

Bob's Grade = $1.47 \times 80 = 117.6\% = \mathbf{100\%}$ (we don't give grades above 100%)

Claire's Grade = $1.11 \times 80 = \mathbf{88.8\%}$

David's Grade = $0.85 \times 80 = \mathbf{68.8\%}$

Elaine's Grade = $0.41 \times 80 = \mathbf{32.8\%}$

Figure 15 - Calculating the students final grades

It is clear that three of the students did better than the group mark would have suggested, but two students were worse off. According to the peer assessment, that's a fair result.

Weightings and Penalties

That's not quite the end of the story though, as the calculation above assumes that the entire group mark should be adjusted using the peer assessment. This can lead to large spread of marks. Fortunately, WebPA allows the algorithm to be adjusted, using a couple of extra parameters, controlling the spread of marks.

PA Weighting

The first parameter that can be changed is the PA Weighting. This defines how much of the overall group-mark should be fixed (given to all the students automatically), and how much should be peer-assessed (calculated using the algorithm above).

If instead of peer-assessing the entire group mark it is possible to use 50% instead, then all 5 students would automatically receive the other 50% of the group mark. In this case, with an overall group mark of 80%, that's an automatic **40%** fixed, and the remaining **40%** will be adjusted by the peer assessment. The students final grades would then become:

Alice's Grade = $40 + (1.14 \times 40) = \mathbf{85.6\%}$

Bob's Grade = $40 + (1.47 \times 40) = \mathbf{98.8\%}$

Claire's Grade = $40 + (1.11 \times 40) = \mathbf{84.4\%}$

David's Grade = $40 + (0.85 \times 40) = \mathbf{74\%}$

Elaine's Grade = $40 + (0.41 \times 40) = \mathbf{56.4\%}$

Figure 16 - WebPA weighted marks

The spread of grades has been reduced substantially in Figure 12. Bob's previous grade was 117.6% but this has been brought down to 98.8%. Similarly, Elaine's low score of 32.8% has been brought up to 56.8%.

Non-Completion Penalty

The second parameter is the non-completion penalty. For students who didn't take the peer assessment, a penalty of up to 100% can be awarded to the final grade.

As an example, awarding a penalty of **10%**, most of our students would be unaffected, but Elaine who failed to take the assessment would receive a 10% penalty:

<p>Elaine's Grade = weighted WebPA mark – non-completion penalty</p> <p>therefore</p> <p>Elaine's Grade = 56.4 - 10% = 50.76%</p>
--

Figure 17 - Non-completion penalty calculation

For more information

To get more information about the WebPA system and the current JISC project please visit the project website <http://webpaproject.lboro.ac.uk>, or join the mailing list <http://www.jiscmail.ac.uk/lists/WEBPA.html>.

References

Willmot, P., Crawford, A., 2005, Validating the assessment of individuals within undergraduate teams, ICEE 2005

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