The TeCTra online groupwork tool: Scaffolding the learning of self and peer assessment

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A reliable assessment strategy for allocating different summative marks for individual contributions in groupwork is a perennial problem that using the TeCTra online tool can resolve. By collecting weekly quantitative and qualitative data to support the individualising of contributions and summative marks the tool supports and scaffolds the students' learning of self and peer assessment understandings, knowledge and skills. This paper discusses the changing design of peer assessment from 1998 to 2008 and the impact of the TeCTRa groupwork tool within a capstone undergraduate subject with large student numbers at UTS. The TeCTra strategy has delivered more diversity of individual summative marks than those reported in the literature and experienced by the authors in the period before the introduction of the tool in 2004. The system for calculating an individual contribution factor has released the academic from the enormous workload otherwise required to process any similar paper-based strategy.

Keywords: individual marks for groupwork, student learning of self and peer assessment, designing peer assessment

Introduction to the TeCTra online groupwork tool

Using the TeCTra (for *Te*am *C*ontribution *Tra*cking) online tool in subjects with large groupwork assignments addresses the well-known difficulties in how to allocate individual marks for groupwork outcomes. A reliable summative assessment strategy for allocating different marks for individual contributions is a perennial problem that using the online tool can resolve. In the process of collecting quantitative and qualitative data to calculate a weighted individual contribution factor to support individualising summative marks, the tool supports and scaffolds the students learning of self and peer assessment understandings, knowledge and skills.

In collecting the data for calculating the individual contribution factors the TeCTra online tool supports and scaffolds the development in students of the ability to self and peer evaluate, give effective feedback, and to reflect and review on their own and their team's performance. Students practice making professional judgments, to articulate well-justified decisions and to communicate in a non-confrontational manner to their peers. These are core attributes for most novice professionals (Raban and Litchfield 2007).

The thesis of this paper is that the greater the visibility of individual contributions the greater is the ability of group members to reflect the actual contribution of each individual in peer assessed summative marks. Using TeCTra scaffolds the weekly practice of student evaluation, feedback, reflection and review skills when self and peer assessing individual contributions to large group projects. Individual contributions are evaluated for quality by systematic quantitative and qualitative formative self and peer assessment. We demonstrate that the use of the online tool has resulted in a wider distribution of individual marks in groupwork than before its use.

Since 1998 by implementing different support strategies for peer assessment of individual contributions the authors have identified a markedly wider distribution of the student allocated marks. The summative marks now more reflect the reality of differing team member contributions. This paper presents the evidence that this substantial change has occurred with the use of the TeCTra online tool since 2004.

The literature indicates that a sustainable teaching and learning strategy is still needed to develop self and peer assessment attributes and capacity in students. The approach that is required is ideally formative, diagnostic, developmental and summative (Goldfinch 1994; Gatfield 1999). This ideal has been difficult to achieve and remains as an important and unresolved feedback and assessment need (Lejk and Wyvill 2001; Li 2001). Using the TeCTra online tool in large groupwork projects addresses this as yet unresolved issue in tertiary education.

The TeCTra online tool's system for data-collection, presentation and calculation of individual contributions releases academics from the unsustainable amount of work required to process any similar paper-based strategy.

With funding from a 2006 Carrick/ALTC Priority Project Grant the prototype TeCTra online tool has been extensively pilot-tested, evaluated and re-developed and is now ready for national and international dissemination by the ALTC for use wherever large groupwork projects are assigned to students

Assessing individual contributions in large groupwork assignments

Assessing individual contributions in group projects and assignments is a perennial problem. Many professional award courses have key capstone subjects with large groupwork projects and students are often given responsibility to allocate individual marks according to the perceived individual contribution made by each team member. Students who have the best insight, though possibly not a completely accurate one, about the individual efforts contributed by team members when faced with the difficult task of peer assessment often find it too hard resulting in an equal distribution of marks irrespective of the actual contributions (Rosen 1996; Lejk and Wyvill 2001; Kennedy 2005; Raban and Litchfield 2007). As a result, good students are dissatisfied with their summative marks while those students who choose to do less receive undeserved rewards.

When facilitating peer assessment with a holistic approach (Schechtman 1992; Schechtman and Godfried 1993) the common assessment strategy for groupwork of allocating the same or almost the same mark to all team members is not adequate as the project tasks are extensive, the teams are large in number (more than 4 members), extend for the whole semester and groupwork can constitute 100% of the final student assessment. The subject coordinator has limited opportunities to observe and assess the complex group and teamwork dynamics that are taking place (Raban and Litchfield 2007).

Some ways of addressing this assessment problem are:

- Tracking individual contributions in the final deliverable. The problem with this approach is that it becomes detrimental to teamwork as the team members are more interested in making sure that their parts of the submission look good as opposed to contributing to the overall quality of the groupwork.
- Testing the students individually to assess their contributions. This approach is based on the questionable assumption that through an assessment of personal knowledge and skills one can infer how much the individual contributed to the project.
- Adopting criterion-based peer assessment as used in SPARK (Freeman & McKenzie 2002). Students are asked to assess each other using a set of criteria usually on completion of the project or at milestones. The problem here is in making sure that the criteria used can give an indication of individual contributions and in ensuring that the criteria are consistently used by all students. An additional difficulty is that this kind of assessment covers work done over lengthy periods of time raising an issue whether early efforts are taken into account in the assessment.

In contrast with other criterion-based peer assessment tools, TeCTra uses a holistic approach for incremental and cumulative performance assessment giving students a progressive status of their standing in the group. The student can use this formative feedback for diagnostic and developmental purposes through review, reflection and adaptive behaviours.

For summative assessment purposes a 'pool' of marks for each group project can be generated in various ways depending on learning objectives and the task. The pool can then be divided amongst the team informed by TeCTra's weighted contribution factor for each student. The individual contribution factor can be mandated to determine each student's final mark for the groupwork. Alternatively, and as an additional peer assessment learning activity, the factors can be used by the students as evidence and a guide to differentiate contributions and to determine a final mark for each individual.

TeCTra supports and scaffolds the learning of self and peer assessment

The cognitive development of the evaluation, feedback, review and reflection skills required to self and peer assess complex teamwork processes is a key learning objective of large project-based subjects. It is important for the novice professional to practice assessing their own and their peer's performance. By using TeCTra students' experience receiving peer evaluation and learn to reflect and review and benefit from the feedback received. Knowledgeable yet inexperienced individuals are scaffolded to act professionally as they take responsibility for and accept the consequences of their own contribution to groupwork projects. These are skills every professional should possess and be able to use for different purposes It is also important for the novice professional to experience being on the receiving end of peer-reviews and assessment and to learn to review, reflect and benefit from any feedback received (Raban and Litchfield 2007).

The TeCTra learning and assessment strategy and online tool requires each student to report on project deliverables, and rate and comment on their team-members work on a weekly basis. This task is informed and supported by evidence of the work done and outcomes achieved by each student. This strategy creates a formative, developmental and summative assessment environment in which the students can learn the skills of self and peer assessing using qualitative comments and holistic quantitative ratings.

Peer assessment has been shown to support not only students learning but also improve their understanding of assessment processes themselves (Bloxham and West 2004). Peer assessment is required to assess individual contributions to group assignments (Johnston and Miles 2004). However peer-assessment for assessing individual contributions to groupwork is controversial because it can produce 'unreliable' results caused by the inexperience of the student assessors and by often producing undifferentiated marks (Kennedy 2005). Also the labour intensive processes the subject coordinators have to administer are problematic (Clark et al 2005).

Using the TeCTra online tool addresses these concerns and presents a learning and teaching strategy for the peer-identification of individual contributions in large groupwork based subjects. The paper argues that the greater visibility of individual contributions and their quality created by systematic formative self and peer assessment, the greater is the ability of the groups to reflect actual contributions of team members in summative peer assessment. The visibility of individual contributions and outcomes in groupwork empowers good performers to claim better marks and convinces laggards to accept lower marks. Using TeCTra does result in a wider distribution of individual marks in large task groupwork.

Research method

The authors use longitudinal studies that investigate the impact of peer and self assessment on the allocation of individual marks for groupwork. The research involved groups of students working on software projects in a project-based subject from 1998 to 2008. In the selected subject, the groupwork contributed 100% to the final mark. During the period under investigation:

- while a different cohort of students was studying each semester, the students came from the same group of courses and had very consistent background and characteristics, and
- the subject retained the assessment pattern, the project structure (although case studies involved were changing), the group size and the rules of allocating individual marks.

There are three distinct periods in which self and peer assessment of individual contributions was assisted in different ways. These are:

- the summative assessment of contributions without on-line support (years from 1998 to 2001),
- the summative assessment of contributions with time recording (years from 2002 to mid-2004), and
- the formative and summative assessment of contributions with time recording, weekly qualitative feedback and quantitative ratings (years from mid-2004 to 2008).

These three periods have shared the same rules for individual mark allocation: irrespective of the level of support provided, ultimately the groups themselves were responsible for allocating individual marks. The ability to differentiate final marks by the groups is used as a measure of the impact of the different level of support given to groups in assessing individual contributions. To make the analysis statistically significant, only semesters with 10 or more groups are included in this study.

A coefficient of standard deviation of the final individual marks is used as an indicator of the extent to which the group was able to align marks with individual contributions. In order to understand whether distributions of the coefficients of variation are similar (that is, are likely to come from the same population) or significantly different, the Kruskal-Wallis non-parametric test is used for analysis of more than two groups of semesters, and the Mann–Whitney–Wilcoxon non-parametric test is used for analysis of two groups of semesters. In this way, it can be shown that some groups of semesters or semesters had similar distribution of the coefficient of variation (indicated by a test significance level $p > 0.05$) or significantly different distribution patterns (indicated by a test significance level $p < 0.05$).

To present the distribution patterns graphically the coefficient of variation is expressed as a percentage. For each semester, a graph showing percentages of groups that differentiated their contributions by 0-5%, 6-10%, 11-15%, 16-20% and 21%+ are plotted. For example, if in a semester there were 12 groups and 6 of them differentiated the final marks in the range 0-5%, 4 in the range 6-10% and 2 in the range 11-15%, the graph shows 50% bar for 0-5%, 33% for 6-10% and 17% for 11-15%.

Subject description for the TeCTra case-study

Systems Development Project (SDP) is a capstone subject in the Bachelor of Science in Information Technology at UTS with 350-400 students each year. The degree has three years of course work and a year of industry training. SDP is taught in the second semester of the second year and aims to prepare the students for industrial training in the third year. Before undertaking SDP the student has completed three semesters of IT education in programming, systems design and development, networking and information systems. During SDP the students experience working in a large team and learn how to apply their prerequisite knowledge to a practical system development problem. During the project they develop a system from specifications to a working software product (Raban and Litchfield 2007).

SDP involves groups of 7-10 students in a major project that takes 50% of their study time (12 credit points) for a fulltime student for one semester of 14 weeks. The groups have a great degree of autonomy. They are responsible for planning and allocating project tasks and organizing work in the groups. Academic tutors, usually Project Managers from industry, are subject Project Managers responsible for overseeing the groups' progress and attending to problems with group dynamics and project work.

There are two milestones in the project, a mid-semester review and a final review, and each produces 50% of the final assessment pool of marks. Each of the two assessments comprises a peer review by another group (worth 40%) and an academic staff review that assesses written submissions (worth 60%).

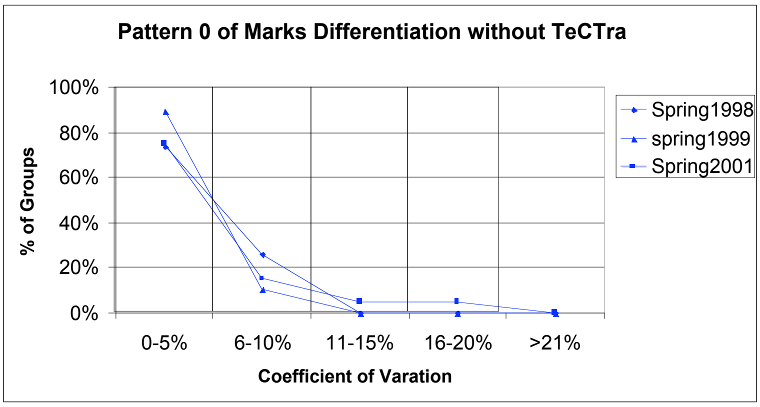
During the peer reviews each group assesses an oral presentation given by another group. The presentation takes 20 minutes and is followed by 10 minutes of question and answer time. The reviewers make their assessment against a set of given criteria that the designers were to achieve through their solutions. During the presentation each member of the reviewing team does their own criterion-based assessment of the presented solutions. The group discusses the individual marks and consolidates them into a whole group assessment which is given to the presenters and accounts for 40% of the total mark. There is a requirement that the marks given to the other group are properly justified and both the advantages and disadvantages of the presented designs are assessed.

The project outcomes as assessed by the peer and staff reviews produce an overall mark for the group effort. This mark is then multiplied by the number of students in the group and the result becomes a pool of marks that the group members must distribute amongst themselves according to their peer assessment of individual contributions to the project. Guided by instructions given to them in the assessment policies and procedures a meeting of all the team members is convened to discuss the mark allocation. 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 through discussion and negotiation the group arrives at an allocation of the marks that all team members can agree on. The results are then presented to the Project Manager, a staff member, for approval. Once the consensus on the mark allocation is confirmed the individual summative marks are accepted.

Summative assessment of contributions without TeCTra support

In the years from 1998 to 2001 the students had to rely on their own records and recollections of individual contributions in allocating individual marks. The only support given to the groups was a set of rules and policies that spelt out a range of good practices for peer assessment. Occasionally groups were not able to reach a consensus and a staff member was called in to break a stalemate in the mark negotiations. It has to be stressed however that the academic tutors would never engage in the actual assessment of contributions. Instead the Project Manager (tutor) would assist the group to choose an acceptable method of assessing contributions and then assumed the role of an impartial facilitator of the method's implementation. As a result in semesters Spring Semester 1998, Spring 1999 and Spring 2001, the distribution of peer marks were diversified as shown in Figure One.

Figure One presents marks differentiation in the period 1998 to 2001. For each semester, the graph shows what percentage of all groups produced individual marks for the project differentiated within five bands 0-5%, 6-10%, 11-15%, 16-20% and >21%. For example, in Spring 1999 around 90% of all groups opted to have marks differentiated within 0-5% and the remaining 10% had marks spread in the 6-10% range.



Pattern 0 Analysis[(a,b)]

	CoVar
Chi-Square	3.975
df	2
Asymp. Sig.	.137

[a] Kruskal Wallis Test
[b] S1998, S1999, S2001

Figure 1: Pattern 0 of mark differentiation before TeCTra

A Kruskal Wallis test indicates that in this period the distribution of mark diversification does not show significant differences across the three semesters studied (p=0.137 > 0.05). This consistent distribution pattern in the period is referred to as Pattern 0. The graph shows that in Pattern 0 between 75% to 90% of all groups opted for an almost equal mark distribution. This result is consistent with similar cases reported in the literature (Rosen 1996; Lejk and Wyvill 2001; Kennedy 2005). This nearly equal distribution of marks was hardly plausible as in a groups of 10 students one would expect a wider range of individual contributions.

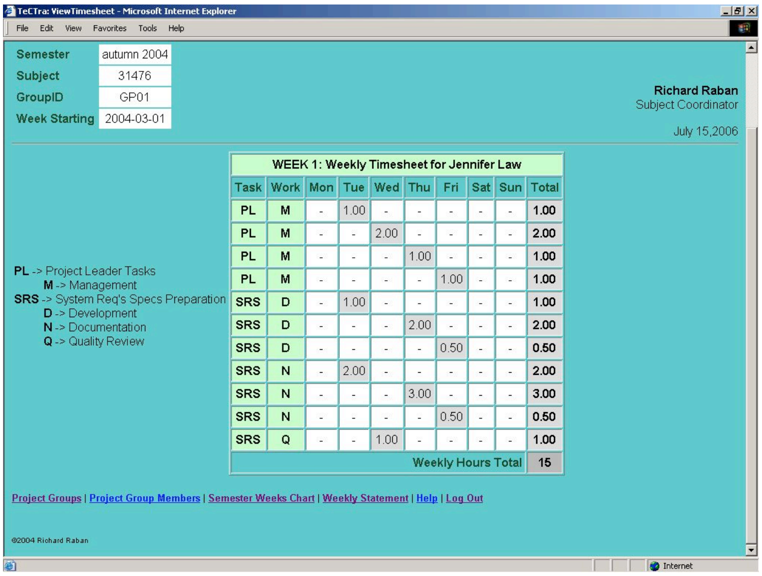
Summative assessment of contributions with time recording

In the years from 2002 to mid-2004, in order to better support peer assessment of individual contributions the students used an online tool for recording individual time spent on the project. The time records were collected on a weekly basis, stored in the system and made available to all the team members for perusal as in Figure Two.

While reporting the hours, the students had to state which task and what type of work the hours were spent on. In Figure Two the fictional student Jennifer Law spent a total of 15 hours working as a Project Leader and on Requirements Specification tasks engaging in management, development, documentation and quality review.

The time records made individual efforts visible to the team members and thus could be used to inform the process of assessing individuals. It ensured that all work from early attempts, possibly no longer visible in the final product and easily forgotten, could be taken into account in the summative mark allocation.

As a result of the use of time records in semesters Spring 2002, Spring 2003 and Autumn 2004 the distribution of peer marks were diversified as shown in Figure Three.



Semester	autumn 2004
Subject	31476
GroupID	GP01
Week Starting	2004-03-01

Richard Raban
Subject Coordinator
July 15,2006

PL -> Project Leader Tasks
M -> Management
SRS -> System Req's Specs Preparation
D -> Development
N -> Documentation
Q -> Quality Review

WEEK 1: Weekly Timesheet for Jennifer Law

Task	Work	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
PL	M	-	1.00	-	-	-	-	-	1.00
PL	M	-	-	2.00	-	-	-	-	2.00
PL	M	-	-	-	1.00	-	-	-	1.00
PL	M	-	-	-	-	1.00	-	-	1.00
SRS	D	-	1.00	-	-	-	-	-	1.00
SRS	D	-	-	-	2.00	-	-	-	2.00
SRS	D	-	-	-	-	0.50	-	-	0.50
SRS	N	-	2.00	-	-	-	-	-	2.00
SRS	N	-	-	-	3.00	-	-	-	3.00
SRS	N	-	-	-	-	0.50	-	-	0.50
SRS	Q	-	-	1.00	-	-	-	-	1.00
								Weekly Hours Total	15

Project Groups | Project Group Members | Semester Weeks Chart | Weekly Statement | Help | Log Out

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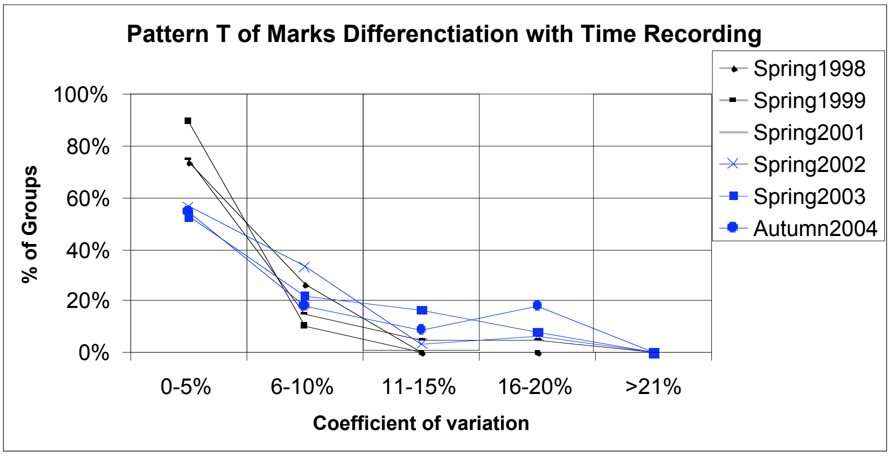
Figure 2: Time recording for informing peer assessment



Pattern T Analysis(a,b)

	CoVar
Chi-Square	.745
df	2
Asymp. Sig.	.689

a Kruskal Wallis Test
b S2002, S2003, A2004

Pattern 0 vs Pattern T(a,b)

	CoVar
Chi-Square	17.521
df	5
Asymp. Sig.	.004

a Kruskal Wallis Test
b S1998, S1999, S2001, S2002, S2003, A2004

Figure 3: Period with time records available

A Kruskal Wallis test indicates in Period T there is no evidence of any significant differences in marks differentiation in the three semesters studied (p=0.689 > 0.05). However, there is a statistically significant difference between Periods 0 and T (p=0.004 < 0.05) as demonstrated in the analysis of both periods. Figure Three shows that the time recording tool reduced the percentage of the groups electing an easy way out by giving everybody equal or almost equal marks to some 55%. This is an improvement on Period 0, yet the general pattern of distribution still indicates a significant reluctance to differentiate marks for individuals within the groups.

Providing the students with evidence of who was doing what and how much time was spent on the tasks empowered a greater number of groups to diversify marks. It is an improvement on the previous situation yet the general pattern of most groups is still in the 0-5% band indicating ongoing difficulties with the peer assessment of individual contributions. In both periods O and T, when an holistic summative peer assessment strategy was used, the results are consistent with those presented by other authors (Rosen 1996; Lejk and Wyvill 2001; Kennedy 2005).

Apparently being informed about time spent did not easily translate into peer contribution ratings as time records do not take into account the quality of work and the level of participation in leadership, motivating team members or organising team work. The results achieved by (Lejk and Wyvill 2001) seem to confirm this argument. Their work demonstrates that the summative category-based approach to peer assessment in group projects produced a wider and smoother distribution of individual marks than the summative holistic one. The holistic approach produced a lot of almost equal marks with only extreme cases of over-or-under performance reflected in mark differentiation.

However the likely cause of this mark distribution is the fact that minor differences in contributions are not easy to quantify especially if there is a considerable time lapse between the work done and its assessment. Only very poor or outstanding efforts seem to be recognised and reflected in the final distribution of marks.

Formative and summative assessment of contributions using TeCTra

In semesters from mid-2004 to 2008 the students were supported by a prototype TeCTra online tool. The prototype tool was based on the principles discussed earlier and provided support for

- quantitative (time records) and qualitative (project deliverables) self-assessment, and
- quantitative (contribution ratings) and qualitative (confidential feedback) peer assessment
- a progressive calculation of weekly weighted contribution factors that shows each team member's standing in terms of perceived individual contributions to groupwork by their peers.

The contribution ratings use a simple rating scale to distinguish between different levels of achievement. This acknowledges the fact that assessment is a difficult task even for experienced academics (Beard & Hartley 1984; Grainger, P., Purnell, K., & Zipf, R. 2007). Peer assessment is even harder as it is performed by novice markers. As Goldfinch (1994) observed students had difficulty distinguishing between 'above average' and 'average' levels of achievement. In TeCTra there are only four levels of holistic achievement each linked to a simple judgement.

- *0* – no contribution when a team member did not do any work,
- *1* – below normal contribution when a team member visibly lagged behind the group in his/her efforts,
- *2* – normal contribution when a team member contributed on par with the other team members,
- *3* – above normal contribution when a team member visibly contributed more than the other group members.

From the beginning of the project, each team member can check how the group rates her or his contribution. In Figure Four the bottom line shows the lowest individual contribution factor in the group for each week and the top line shows the highest individual contribution factor for each week. The middle line plots the individual contribution factors of a fictional student Bertil Lundgren. This student consistently increased his contribution to the group effort and gradually improved his position in the group to become one of the top contributors. He appears to have responded positively to the earlier indication of the group's dissatisfaction with his contribution and he reviewed, reflected and adapted and became a more effective team member.

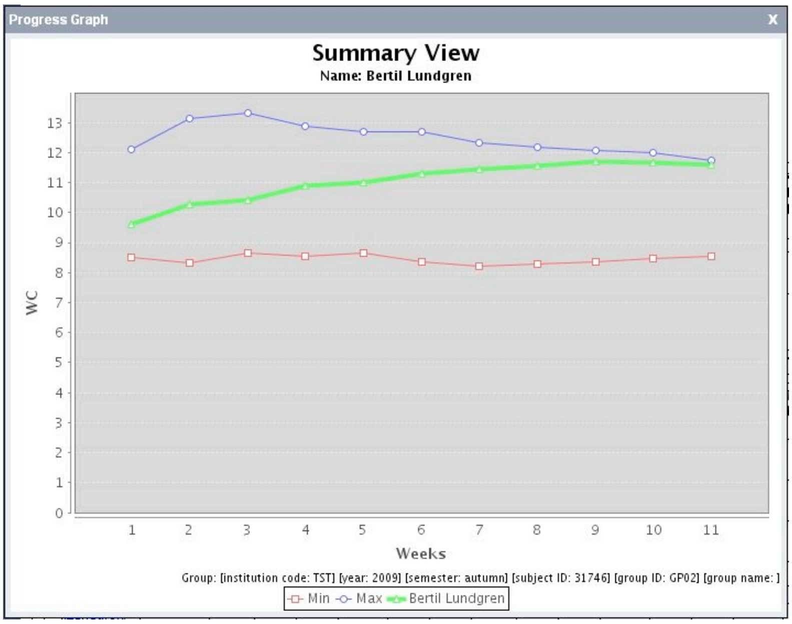
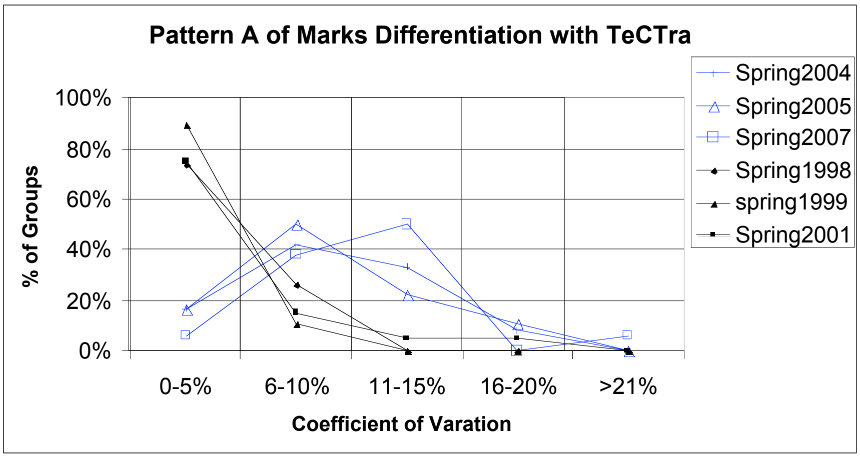


Figure 4: Graphic representation of an individual's standing in the group

As a result of using TeCTra in semesters from Spring 2004 to Spring 2008, the distribution of peer marks show a dramatic decrease in the percentage of groups distributing marks almost equally (0-5% coefficient of standard deviation). Through statistical analysis of the mark differentiation distribution in the period when TeCTra was used, there are three distinct mark diversification distribution patterns marked as Pattern A observed in Spring 2004, Spring 2005 and Spring 2007 (Figure Five), Pattern B observed in Autumn 2005, Autumn 2006 and Spring 2008 (Figure Six) and Pattern C (Figure Seven) observed in Spring 2006 and Autumn 2007.

It is not known what caused the differences in the Patterns A, B and C, however it is clear that each pattern is significantly different to the pre TeCTra Pattern 0 (as indicated by *p*=.000 < 0.05 in statistical tests). This is statistical evidence that using TeCTra had radically altered student attitudes and their capacity to peer assess individual contributions in groupwork.



Pattern A Test Statistics[a,b]

	CoVar
Chi-Square	4.625
df	2
Asymp. Sig.	**.099**

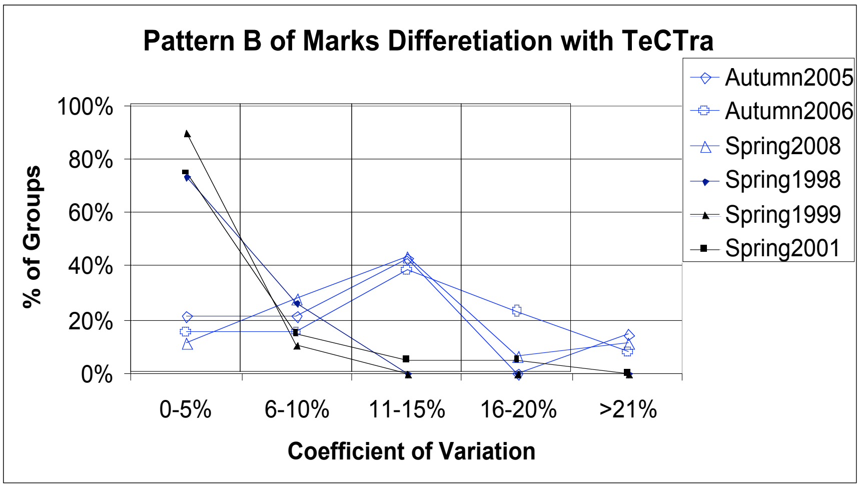
[a] Kruskal Wallis Test
[b] S2004, S2005, S2007

Pattern0 vs Pattern A Test[a]

	CoVar
Mann-Whitney U	393.000
Wilcoxon W	2104.000
Z	-7.119
Asymp. Sig. (2-tailed)	**.000**

[a] Pattern 0, Pattern A

Figure 5: Pattern A of mark differentiation with TeCTra



Pattern B Test Statistics[a,b]

	CoVar
Chi-Square	.358
df	2
Asymp. Sig.	.836

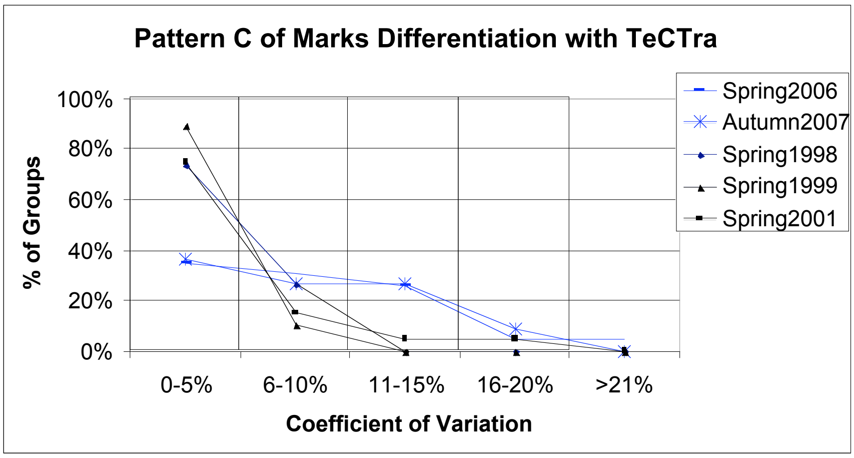
[a] Kruskal Wallis Test
[b] A2005, A2006,S2008

Pattern0 vs Pattern B Test [a]

	CoVar
Mann-Whitney U	260.000
Wilcoxon W	1971.000
Z	-6.953
Asymp. Sig. (2-tailed)	.000

[a] Pattern 0, Pattern B

Figure 6: Pattern B of mark differentiation with TeCTra



Pattern C Test Statistics[a,b]

	CoVar
Mann-Whitney U	123.000
Wilcoxon W	399.000
Z	-.129
Asymp. Sig. (2-tailed)	.897
Exact Sig. [2*(1-tailed Sig.)]	.913(a)

[a] Not corrected for ties.
[b] S2006, A2007

Pattern0 vs Pattern C Test[a]

	CoVar
Mann-Whitney U	421.500
Wilcoxon W	2132.500
Z	-4.569
Asymp. Sig. (2-tailed)	.000

[a] Pattern 0, Pattern C

Figure 7: Pattern C of mark differentiation with TeCTra

Peer assessed individual summative marks supported by TeCTra data

Figure Eight combines the graphs of the distribution of peer marks for the three different peer assessment approaches discussed in the paper. The results demonstrate that without TeCTra's online support the students were not capable of reflecting and assessing individual contributions in the summative marks allocated to group members. Without TeCTra data being available an equal distribution of summative marks was given to 75-90% of their peers (Pattern O).

The visibility of individual work contributed to the project provided by the online time-records improved the situation by reducing the percentage of groups giving a near equal mark allocation to 55% of students. This result proves that reliable evidence of individual efforts empowered team members to claim better marks and the groups were willing to accept resulting summative mark differentiation (Pattern T).

The most significant change in peer assessment mark distribution occurred with the introduction of the TeCTra online system that has supported self and peer evaluation, feedback, review and reflection processes. An equal distribution of peer marks now happens in less than 20% of groups and the distribution has become significantly wider and better reflects the variety of individual contributions expected in large groupwork outcomes (Patterns A-B-C).

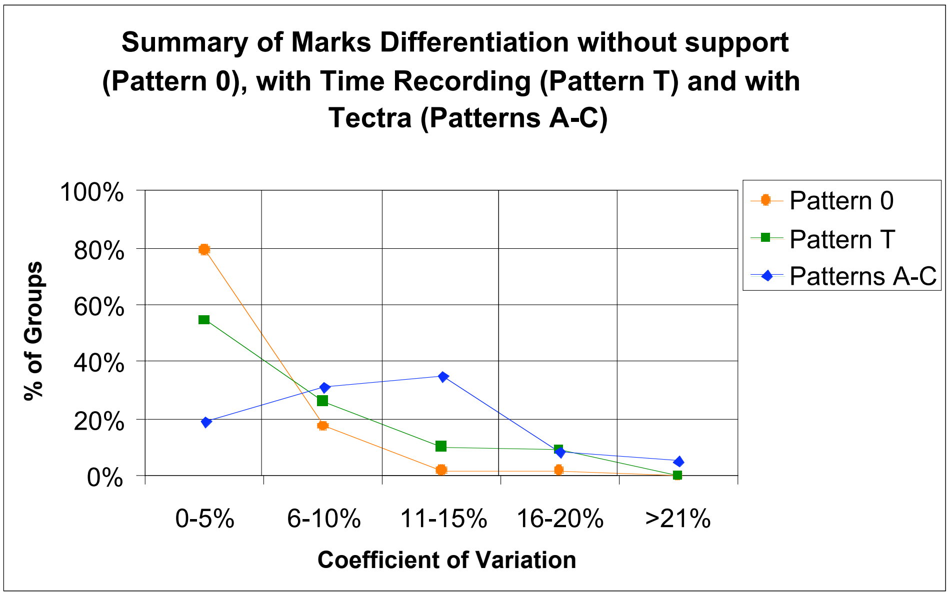


Figure 8: Overview of the changes in the distribution of peer-marks due to changes in peer assessment strategies from 1998 to 2008.

The use of TeCTra has afforded a high level of visibility of individual contributions and outcomes. Together with the time records collected in the early system, TeCTra now also records deliverables produced and a holistic quantitative rating. When peer rating their group members, the students are presented with all the individual results produced in the week being assessed. This ensures that the peer rating process is evidence-based.

The TeCTra online tool supports self and peer evaluation, feedback and review – both quantitative ratings and qualitative comments – throughout the duration of the SDP large group project and thus formatively and developmentally influences individual contributions and behaviours within the team. This improved capacity for self and peer review facilitates diagnostic attributes and can significantly influence the overall project management process. TeCTra's use has seen changes in group dynamics and the resultant summative peer assessment marks though the exact mechanisms of why and how will be investigated through student usability evaluations in future research.

Conclusion

Using the TeCTra online tool is a teaching strategy that supports the learning of evaluative, feedback, review and reflective capacity leading to improved self and peer assessment understandings, knowledge and skills. The tool provides the conditions needed to formatively improve individual performance within groupwork. At the completion of the SDP project the TeCTra data and weighted individual contribution factors enabled and empowered individuals to claim a significantly wider distribution of summative marks than the common strategy of all group members getting the same mark.

TeCTra scaffolds the development in students of the ability to evaluate, give feedback, review, reflect and assess the work of self and peers, to make professional judgments, to articulate well-justified decisions and to communicate in a non-confrontational manner to their peers. These are all core skills and attributes for most novice professionals. Knowledgeable yet inexperienced individuals are supported to act professionally and take responsibility for and accept the consequences of their own contributions to large groupwork projects.

The tool is relatively simple for students and academics to use and avoids complexities and additional work that is present in other online tools (Clark, Davies and Skeers 2005). The tool's user friendliness is important as ever increasing academic workloads leave minimal time for the administration of elaborate self and peer assessment methods and tools (Fisher 1999).

There is still a question about whether TeCTra produces marks that do reflect the true individual contribution of each group member. This is a complex question and in the SDP subject the students were not obliged or mandated to use TeCTra contribution factors for individual mark allocation. Indeed the majority of groups choose not to directly use the TeCTra contribution factors in calculating summative marks. However there has been no return to the previous practice of allocating equal marks to all members. The evidence indicates that the peer assessed marks given by students show a high degree of correlation with the TeCTra generated individual contribution factors. It can be concluded that the use of TeCTra did make the difference in the students' perception of individual contributions and the individual marks allocated to each group member.

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