Final Report

Supporting student self and peer assessment in large groupwork projects

University of Technology Sydney,
Curtin University of Technology,
Queensland University of Technology

Richard Raban & Andrew Litchfield (Project Leaders)
University of Technology, Sydney

Keith Willey, Antoine Hermans, Steve Murray, David Davis
University of Technology, Sydney

Heinz Dreher
Curtin University of Technology

Neil Harris, Katherine Wenham
Griffith University

2009
tectra.it.uts.edu.au

Report Contents

1.0 Executive summary

The TeCTra online tool supports 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 articulating well-justified decisions and communicating in a non-confrontational manner to their peers. These are core attributes, understandings and skills for most novice professionals

Using TeCTra in subjects with large group work assignments also addresses the well-known difficulties in how to allocate individual marks for group work outcomes. A reliable summative assessment strategy for allocating different marks for individual contributions is a perennial problem that using TeCTra can resolve.

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 peers 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 and supported to act professionally as they take responsibility for and accept the consequences of their own contribution to group work projects. These are skills every professional should possess and be able to use for different purposes.

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 group work projects addresses this as yet unresolved issue in tertiary education.

In key capstone subjects with large group work projects, 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 an accurate one, about the individual efforts contributed by team members when faced with the 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 chose to do little receive undeserved rewards.

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 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.

Weighted individual contribution factors can be mandated to determine each student's final mark for the group work. 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 individual marks.

The TeCTra online tool is now ready for national and international dissemination and use wherever large group work projects are assigned to students.

2.0 Project outcomes

Our project's purpose was to further the software architecture and educational design of the prototype tool developed by the project leaders before 2006 through pilot-testing in various disciplines in different Australian institutions. The project was also to commence the dissemination of the tool and to prepare some of the supports required for wider dissemination after the completion of the funding period.

At the completion of the two-year ALTC funding of the project in June 2009 the Project Leaders have successfully delivered;

1. A stable and well-tested software tool ready for wider dissemination within the national and international higher education community;
2. User manuals to support students' use of the tool;
3. User manuals to support academics in managing groups and projects;
4. Full administration and technical support documentation to facilitate the hosting of the tool on local servers anywhere;
5. A website to assist dissemination and to support a global community of users;
6. Growing awareness of the tool and its functionality within the Australian higher education community;
7. Initial presentation of the tool internationally mainly in the UK; and
8. Submission of the Final Project Report.

3.0 General lessons learnt

The advantages of using TeCtra to develop self and peer assessment and to collect data to enable the individualising are discussed elsewhere in this Report.

A major and significant lesson is that in the pilot-testing evaluations a clear majority of students supported the use of TeCTra to facilitate better team communication and better project management.

The levels of support needed for TeCTra adoption are higher than expected. Pilot-testers needed technical and pedagogical support to integrate TeCTra into their teaching practice and subject design. However part of the reason for this support was because technical difficulties arose; pilot-testing is always at the bleeding edge.

The TeCTra online tool will need continuing support and championing now that the project has ended. Innovations need such support while use increases and becomes a critical mass. This essential support in staffing and time will need funds.

It appears there is no similar tool in the UK and a real opportunity exists for an international audience and user-community.

Some other general lessons learnt are:

- Browser incompatibility; TeCTra needs to work with as many web browsers as possible. Enabling this ease-of-use has proven difficult and time consuming. The issue has been overcome but not entirely and will reoccur with future versions of browser software.

- Difficulties with pilot-testers; pilot-testers change the subject's they teach and the assignments thus change and may not include significant group work, or they may go on leave and no longer be available.

- Increased awareness of the significant difficulties of academic staff adoption of innovations in their teaching practice. Colleagues need considerable support and talking through the issues before making a decision about using TeCTra in their subject. They are risk-averse and need to feel safe about using the tool in their disciplinary context. This support takes time and effort and is thus costly.

- Better strategies are needed for academic staff awareness about the importance of better developing professional graduate attributes such as self and peer assessment and teamwork understandings, knowledge and skills.

- Through improving academic awareness of graduate attributes opportunities arise to embed the TeCTra online tool into the curriculum.

4.0 Success factors

The TeCTra online tool provides visibility of individual efforts and outcomes. Further than the time records collected in the prototype system, TeCTra now also records deliverables produced. While rating their team members, the students were presented with all individual results produced in the week being assessed. It ensured that the rating process was evidence-based.

Using TeCTra requires students to holistically peer evaluate and give feedback – both a quantitative rating and qualitative comments – throughout the duration of the project and thus supports reflection, review and adaption activities. These processes formatively and positively influence individual contributions and behaviours within the team. This improved capacity for peer evaluation and review facilitates diagnostic attributes and thus can significantly influence the overall project management process and outcomes.

TeCTra supports the development in students of the ability to evaluate, give feedback, review and assess the work of others, to make professional judgments, to articulate well justified decisions and to communicate in a non-confrontational manner to their peers – core skills and graduate 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 group work projects.

The TeCTra online tool is relatively simple for students and teachers to use and avoids complexities and additional work that present in other online tools (Clark 2000). The online tool's user-friendliness is important as increasing academic teacher workloads leave minimal time for the administration of elaborate self-and-peer assessment methods and tools (Fisher 1999).

5.0 Factors which impeded success

As co-leaders of the project we were busy with software tool design and development while the overall administration and following up contacts with prospective users were not properly looked after due to a lack of time.

However the funds that were not spent on a Project Manager were then available to maximize the programming and development of the tool which was essential for the best outcome in the design and stability and robustness of the TeCTra online tool.

The pilot-testing overlapped with design and development thus exposing the testers to software problems. While it is natural to have problems during testing, it made the software look unstable and unreliable. In some instances, the benefits of technology testing came at the expense of educational outcomes; a user who ran into technical problems was likely to abandon using the system. There was simply too much extra work finding workarounds for the students.

Nevertheless this is what pilot-testing software is all about; finding out in real practice how the tool performs, locating problems, then resolving them for the next cycle of testing.

A major impediment during the course of the Project was that robust technologies for developing browser independent web interfaces became available only half-way through the project. They were unable to be incorporated into the tool without a major reworking of the software. This exposure to the changing web browser technologies created considerable additional work to align the software with Internet Explorer v6 and Mortzilla Firefox v3.

These problems were successfully overcome and the final product works on a wide range of web browsers. This is an essential facility in the wider dissemination and distribution of the TeCTra online tool.

Future internet browser protocols will require further development with new versions of the TeCTra tool. Such updating is expected with all software and will need to be funded by the ALTC.

6.0 Extent to which approach/outcomes are amenable to implementation in other institutions

A thoroughly-tested, stable, online software tool is now available for wider dissemination within the national and international higher education community.

The tool is supported with full documentation for student-users and teacher-users. Full administration and technical support documentation is provided to facilitate and implement the hosting of the TeCTra online tool on local servers anywhere. Paper copies of this documentation can be downloaded at www.altc.edu.au/resources

The website provides convenient access to the TeCTra software and support documentation, frequently asked questions (FAQ) information, and to the beginnings of a collection of casestudies across the professional and disciplinary spectrum.

A growing collection of case-studies is essential for the adoption of TeCTra by the risk-averse majority of academics who need assurance that adopting the innovation will work in their specific discipline and professional context.

It is intended that the TeCTra website will also facilitate a growing community-of-practice of users who can support each other sharing 'war stories' and their experiences.

The national and international dissemination and sharing efforts of the project leaders to date have been outlined above. These activities include journal articles, conference papers, conference workshops, conference posters and seminars and presentations at other venues.

We intend to continue these activities though, as discussed above, there are limitations to our available time and funds.

In particular we intend to:

1. Publish articles in international Higher Education Assessment and Educational Technology Journals;
2. Continue to participate in national conferences, for example the ATN Assessment conference in November 2009 where a paper abstract has been accepted; and
3. Continue to build the TeCTra support website with more case-studies and host a community-of-practice. This ongoing task will be limited by our lack of funds.

Realistically, these future activities would be enabled and improved with the further availability of ALTC funds to facilitate ongoing dissemination and support.

Digital and paper copies of all project user manuals and technical documentation are available as separate downloads at www.altc.edu.au/resources

From now it is envisaged that the TeCTra software and user-manuals will be principally accessed from the website http://tectra.it.uts.edu.au/ .The website also will include a growing collection of case-studies from different disciplines and contexts. The TeCTra website also hosts a community-of-users facility and forum.

7.0 Dissemination

The diffusion and dissemination of innovations is always difficult and, in particular, significant changes to the university curriculum and academic practices require considerable support and so are costly and take time to implement. Worthwhile attempts at curriculum and assessment renewal have often ended in failure and not become a practice of the early and late majority (Rogers 2003). This project's experience confirms these observations.

Immediately following various presentations and workshops of the TeCTra tool, both in Australia and internationally, considerable interest in its potential use was expressed by academics. However this initial interest did NOT translate to actually adopting the tool as a significant teaching and learning strategy.

The pilot-tester financial incentive from the ALTC grant was essential for the success of the trialling and evaluation of the tool's two iterative software development cycles during the project. Pilot-testing would NOT have happened without this funding incentive.

The good news is that the pilot-testing, and the usability and technical difficulties revealed and subsequently overcome, was successful. A thoroughly-tested, stable, ready for use, online software tool is now available with full documentation for national and international dissemination.

Further good news is that, in all forums where the tool was presented and discussed, there was well-informed and unanimous recognition and agreement that better learning by students of self and peer assessment skills is very important, indeed essential, for becoming a novice professional. It is also recognised that sustainable strategies to individualise reliable marks in large group work projects are needed in tertiary education.

This sector-wide awareness is growing as a significant issue for curriculum renewal as the development of better professional graduate attributes gathers momentum. Increasingly government, employers, professional societies and accreditation agencies are speaking with one voice about the need for university graduates to have better employability knowledge and skills.

In summary, our recommendations regarding dissemination are:

Recommendation One:
The future dissemination of TeCTra needs to be located within the growing trend for better teaching and learning of professional graduate attributes. The tool develops self and peer assessment understandings and skills, promotes better project management and teamwork processes and assists with differentiating individual contributions to teamwork for summative assessment purposes. All these outcomes support the improvement of graduates' professional attributes and capacity for successful employment.

Our national dissemination efforts were also limited by the need for a sector-wide professional marketing and publicity campaign. The project's funded budget did not include such a campaign. The project leaders do not have the key knowledge and skills that are required, nor the time, nor the funds, necessary for a proper marketing campaign's design, development and implementation. Our efforts were, and continue to be, limited to paper presentations, workshops and posters at academic conferences

and similar venues. For example we have a paper accepted at the ATN Assessment conference in November 2009. The funds to support the project leaders' ongoing dissemination activities are problematic as they need to be procured internally and this is increasingly difficult due to organisational financial constraints.

Recommendation Two:

Wider national dissemination of TeCTra will require further time and funds. We suggest a national roadshow of workshops where academics interested in better developing their students'self and peer assessment skills can be shown the tool and can discuss adoption issues. The TeCTra website and community-of-user support is a vital and continuing underpinning of any such series of national workshops. Such a national roadshow should include other key ALTC assessment artifacts.

The international dissemination of TeCTra commenced in April 2008. We presented TeCTra at seminars at Edinburgh University and Strathclyde University to considerable interest. Indeed UK academics seemed more aware of the importance of developing self and peer assessment attributes than our colleagues in Australia.

Recommendation Three:

The international dissemination of TeCTra also needs further funds and relevant expertise in developing and actioning dissemination strategies.

As the project leaders we are interested to support the further dissemination of this project, however we have limited time and no funds to do so. Though we intend to use TeCTra for further research on group work dynamics and self and peer assessment, the time and effort required to actively promote the ALTC's TeCTra tool and teaching and learning resources would require additional funding support.

Recommendation Four:

We recommend that the ALTC establishes a professional marketing and publication capacity to ensure the best possible national and international dissemination for its growing 'library' of teaching and learning tools produced from its various grant schemes. Funds also need to be made available for project leaders to continue their support and dissemination efforts on completion of their ALTC grant.

A website has been developed to assist dissemination and to support a potentially global community of users. The website has been built with the technical capacity to properly support considerable future expansion and use. The site is based on an easy-to-use CMS that allows gradual content development. However, as the TeCTra body of experience and case studies grows, the future updating of the website is contingent on the time and funds available to the project leaders.

Recommendation Five:

We recommend the ALTC consider resourcing the need for the ongoing TeCTra website development and community-of-users support. The project leaders do not have these resources.

Recommendation Six:

Future internet browser protocols will require further development with new versions of the TeCTra tool. Such updating is expected with all software. This software development would require funding support from the ALTC.

8.0 Linkages

Disciplinary and interdisciplinary linkages or learning that emerged as a result of the project

Group work is an important teaching and learning strategy in all professional disciplines and courses. The TeCTra pilot-testing to date has involved subjects in Faculties of Business, Engineering, Information Technology and Health Sciences.

The TeCTra online tool has the potential to be used nationally and internationally in all disciplines and courses where large group work projects are assigned. Such projects are found principally in key capstone subjects.

This future wider use and potential linkages are for the ALTC to support and disseminate. The project leaders have made recommendations for future dissemination in this Report.

Links with other ALTC projects which developed during the project and the anticipated benefits to the discipline

The project Leaders were interviewed by Ian Hart from Canberra University, member of the team whose ALTC funded project was about Learning Strategies in Communication and Media courses.

There has been some discussion of the relative merits and applicability of the criterion based peer assessment exemplified by the SPARK tool and the holistic approach adopted by the TeCTra tool. The two tools are being showcased in relevant conference workshops designed by the Project Leaders. (SPARK has not been funded by the ALTC to our knowledge).

International linkages

In April 2008, seminars presenting TeCTra were presented to academic staff at the University of Edinburgh and the University of Strathclyde. Considerable interest was expressed at the time however no actual integration and implementation took place in the subsequent semester.

9.0 Evaluation

The project leaders and the pilot-testers evaluated students' views on using TeCTra by questionnaire and focus groups. Debriefing interviews were also conducted with the pilot testers. Copies of these evaluation instruments can be downloaded at www.altc.edu.au/resources

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 assume the role of an impartial facilitator of the method's implementation. As a result, in semesters Spring 1998, Spring 1999 and Spring 2001, the distribution of peer marks were diversified as shown in Figure One.
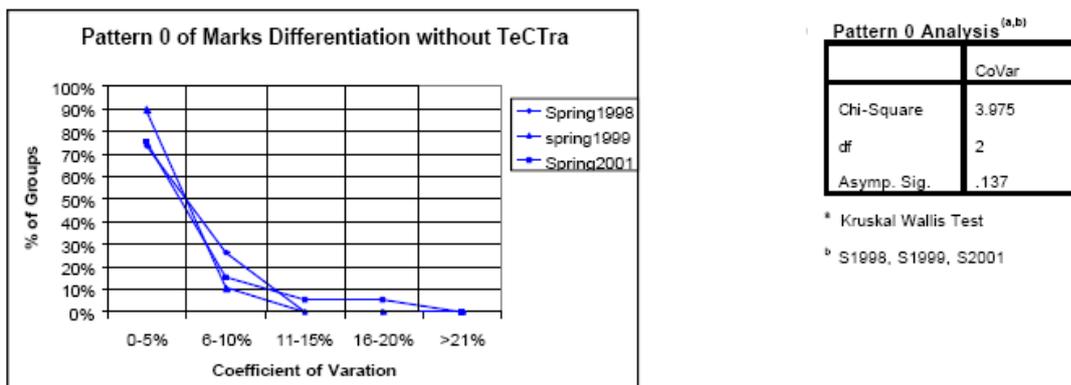

Figure One - Pattern 0 of mark differentiation without TeCTra

A Kruskal Wallis test indicates in this period the patterns of mark diversification did not have significant differences across the three semesters studied (p=.137 > 0.05). This consistent pattern is referred to as Pattern 0. The graph shows that in Pattern 0, 75% to 90% of all groups opted for almost equal mark distribution. It was an expected result in line 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 groups of 10 students one can expect a wide range of individual contributions.

In the semesters from mid-2004 to 2008 the shortcomings of a time-based peer assessment strategy were addressed with the design and implementation of a prototype online group work tool called TeCTra. This tool facilitated:

- time recording, with an additional feature to allow recording of deliverables that were produced during the time reported;
- a confidential feedback system that allow team-members to make qualitative comments on individual contributions directly to each other;

- ̣ quantitative ratings of individual contributions that were done on a weekly basis; and
- a progressive calculation of weighted weekly contribution-factors that indicate how the group rated individual contributions on a weekly basis.
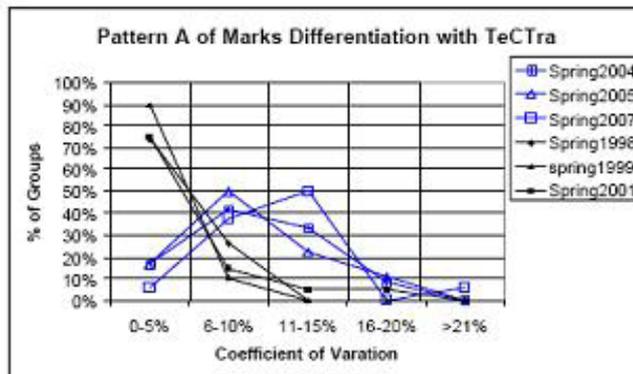
Weekly ratings make peer assessment much easier as the assessed work and group interactions are still remembered by the team members. It also takes away the stress of summative assessment that contributes a large portion of the final mark and therefore creates a lot of tension within the group. The students can be more honest in making judgements on their peers.

Contribution factors calculated for each week and weighted contribution factors calculated for a period of time give quantitative diagnostic feedback to each team member regarding their standing in the group. Additionally, qualitative comments on the work done by team members can be exchanged, facilitating formative feedback that explicitly diagnoses and raises group work issues with the students. The students are not only given quantitative feedback on their perceived contributions but also receive qualitative feedback on their group work efforts.

As a result of using TeCTra in semesters from Spring 2004 to Spring 2008, the distribution of peer marks shows a dramatic decrease in the percentage of groups distributing marks almost equally (0-5% coefficient of standard deviation). Through statistical analysis the mark differentiation distribution in the period when TeCTra was used, there were three distinct mark diversification distribution patterns marked as Pattern A, observed in Spring 2004, Spring 2005 and Spring 2007, Pattern B, observed in Autumn 2005, Autumn 2006 and Spring 2008; and Pattern C, observed in Sprin 2006 and Autumn 2007. The patterns are presented in Figures Two, Three and Four respectively.

At this stage, it is not known what caused the differences, 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 clear evidence proving that TeCTra had radically altered student groups' attitude to the peer assessment of individual contributions. Students had the evidence to argue for individualised summative marks.

Figure Two - Pattern A of mark differentiation with TeCTra

Figure Three - Pattern B of mark differentiation with TeCTra
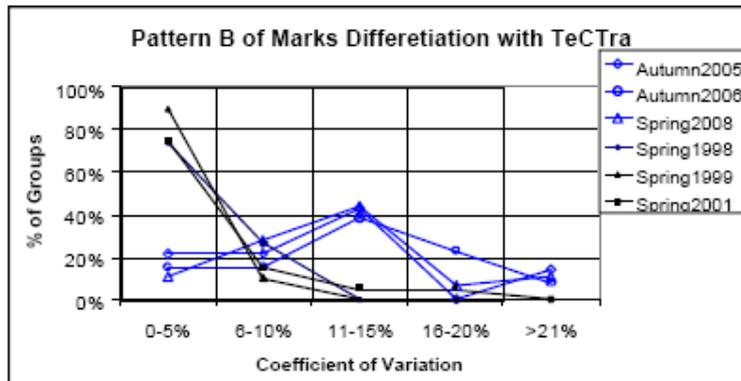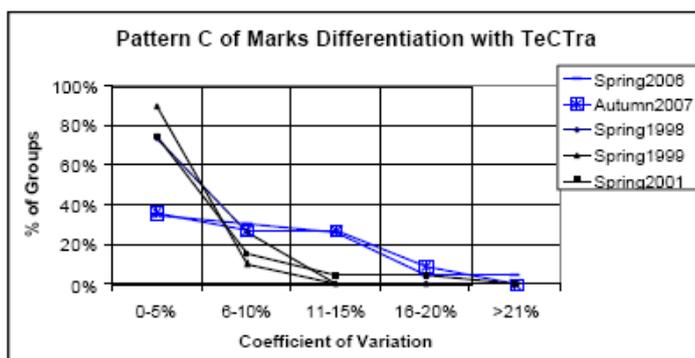
Pattern C Test Statistics[a,b]

	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 Four - Pattern C of mark differentiation with TeCTra

The introduction of TeCTra produced a dramatic change in the students' peer assessment of individual contributions. Only 20% of groups allocated marks with little or no diversification and 65-75% of groups diversified marks by 6-15%. This is a more accurate reflection of the expected range of students' individual contributions within a large group work project.

As the students were not obliged to use the TeCTra-calculated individual Weighted Contribution Factors in allocating their marks, it seems that progressiveness and visibility of peer evaluation, feedback and review empowered individuals to claim their 'rightful' share of the marks. Non-performers were exposed early through the formative assessment of their peers, and they had two options, either to improve or to accept lower summative marks.
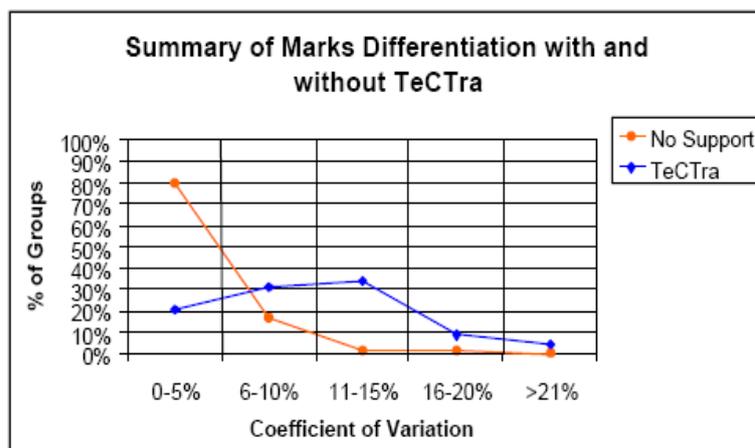
Figure Five – Overview of the changes in the distribution of peer-marks due to changes in peer-assessment strategies from 1998 to 2008.

Figure Five summarises the graphs of the distribution of peer marks for the three peer assessment patterns that have been observed. The results demonstrate that without TeCTra's online support the students were not capable of reflecting individual contributions in the marks allocated to team-members and an equal distribution of marks was given to 75- 90% of their peers.

The visibility of individual work on the project provided by the online time-records improved the situation by reducing the percentage of groups with a near-equal mark allocation to about 55%. This result proved that reliable evidence of individual efforts empowered team members to claim better marks and the groups were willing to accept resulting mark differentiation.

The most significant change in peer-assessment mark distribution occurred with the introduction of the current TeCTra system that has facilitated peer evaluation, feedback and review assessment processes. An equal distribution of peer marks is now less than 20% and the distribution has become significantly wider and better reflects the spread of individual contributions to large group work project outcomes.

There is still a question about whether TeCTra produces marks that do reflect the true individual contribution of each team member. The students are not under obligation to use TeCTra contribution factors for their peer-mark allocation and indeed the majority of groups choose not to use the TeCTra contribution factors. Yet there has been no return to the previous practice of allocating marks close to an equal distribution. It has to be concluded that the online tool did make the difference. It seems to have changed the group dynamics although the mechanisms behind that are not quite clear and will be investigated through student usability evaluations in future research.

10.0 References

Bloxham, S. and West, A. (2004). Understanding the Rules of the game: making peer assessment as a medium for developing students' conceptions of assessment. Assessment and Evaluation in Higher Education. 29(6), 721-733.

Carrick Institute Report (2005). Dissemination, Adoption & Adaptation of Project Innovations in Higher Education. McKenzie, J. Alexander, S. Harper, C. Anderson, S. University of Technology, Sydney.

Fisher, R. (1999). Academic Workloads and Assessment. http://www.tedi.uq.edu.au/conferences/teach_conference99/papers/fisher.html

Freeman, M. & McKenzie, J. (2002). SPARK, a confidential web-based template for self and peer assessment of student teamwork: benefits of evaluating across different subjects. British Journal of Educational Technology, 33 (5) 551-569.

Gatfield, T. (1999). Examining student satisfaction with Group Projects and Peer Assessment. Assessment and Evaluation in Higher Education, 24(4), 365-377.

Goldfinch, J. (1994). Further Developments in Peer assessment of Group Projects Assessment and Evaluation in Higher Education, 19(1), 29-35.

Johnston, L. and Miles, L. (2004). Assessing contributions to group assignments. Assessment & Evaluation in Higher Education. 29(6), 751-768.

Kennedy, G.J. (2005) Peer-assessment in Group Projects: Is it worth it? The Australasian Computing Education Conference 2005, Newcastle Australia.

Li, L. (2001). Some Refinements on Peer assessment of Group Projects. Assessment and Evaluation in Higher Education, 26(1), 5-18.

Lejk, M. and Wyvill, M. (2001). Peer assessment of Contributions to a Group Project: a comparison of holistic and category-based approaches. Assessment and Evaluation in Higher Education, 26(1), 19-39.

Raban, R. and Litchfield, A. (2006a). Peer assessment in large group projects: forming professional attitudes in IT students. Uniserve Conference 2006.

Raban, R. and Litchfield, A. (2006b). Supporting peer assessment of individual contributions in groupwork. In Markauskaite, L., Goodyear, P. & Reimann, P. (Eds), Who's Learning? Whose Technology? Proceedings of the 23rd Annual ASCILITE Conference pp. 685-694. Sydney, 3-6 December. Received Outstanding Paper Award; copy in part Five of this Report. http://www.ascilite.org.au/conferences/sydney06/proceeding/pdf_papers/p159.pdf

Raban, R. and Litchfield, A. (2007). Supporting peer assessment of individual contributions in groupwork. Australasian Journal of Educational Technology, 23(1), 34-47. http://www.ascilite.org.au/ajet/ajet23/raban.html

Raban, R. and Litchfield, A. (2009). Supporting the learning of self and peer assessment in group work. Paper abstract accepted for the ATN Assessment Conference, Melbourne, November.

Rogers, E. (2003) Diffusion of Innovations. Fifth Edition. New York Free Press: Simon & Schuster Inc.

Rosen, C.C.H. (1996) Individual assessment of group projects in software engineering: A facilitated peer assessment approach. Proceedings of the 9th Conference on Software Engineering Education, pp. 68-77, Daytona Beach, Florida. IEEE. UTS (2006). AUQA Performance Portfolio. p3.