Building Successful Teams: a pilot intervention embedding inclusive team skills in an undergraduate system analysis, design and project management course (SADPM)

Elena Sitnikova, Patricia Kelly and Diana Collett

University of South Australia,
Mawson Lakes Campus,
Mawson Lakes SA 5095
Elena.Sitnikova@unisa.edu.au
Patricia.Kelly@unisa.edu.au
Diana.Collett@unisa.edu.au

Abstract: This paper discusses a pilot intervention aimed at embedding team building skills within System Analysis, Design and Project Management, a second year multidisciplinary course at the University of South Australia. The aim was to help students recognise the behaviours that exclude or include others and thus enhance their life-long capacity to work effectively in diverse groups. The intervention developed through collaboration between the course coordinator, industry mentor and tutors, an academic adviser and a student counsellor. The paper uses the teaching team's contributions and reflections to identify challenges and provide insights from their different perspectives. The results of this study are surprising, with lessons learned for future interventions to increase the communicative capacity of students working in diverse teams.

Introduction

Когда в товарищах согласья нет,	*When partners can't agree*
На лад их дело не пойдет,	*Their efforts are in vain*
И выйдет из него не дело, только мука	*Trouble is the only fruit such work will gain*

(Translation from I. Krylov's fable Crayfish, Swan, and Pike)

This paper reports on a new second year interdisciplinary course, *Systems Analysis, Design and Project Management (SADPM)* developed at the University of South Australia (UniSA). It includes a pilot intervention to integrate team building skills in a diverse local and international cohort of 172 students including 22 externals, 19 females, mature age students and many ethnic groups and religions. Consistent with research (Male *et al.*, 2009), the Australian Association of Graduate Employers' (AAGE) Survey (2011) identified four top graduate qualities as team skills, oral communication, personal communication and problem solving. The UK Royal Engineering Academy report urges teaching not only techniques and approaches but behaviours like openness and sharing and skills such as listening, presentation and persuasion (2007, p.29). A large employer survey found that *across industries, countries and cultures*, most employers value "mindset qualities" over "skillset qualities" (Reed, 2011, p.41). Moreover, growing global crises call for professionals who are good global citizens, assuming responsibility for their impact on communities and the planet (Nussbaum in Oriel, 2011; Kelly, 2010, Dowd, 2010). So, what curricula can support technical skills and personal capabilities and how do we know if what we are doing is effective?

Effective communication and international perspectives are desired Graduate Attributes at UniSA. The coordinator wanted to include team work and active learning opportunities to help students in their transition from learning 'what' to learning 'how', as Figure 1 below demonstrates. Her request for

support from the Learning and Teaching Unit resulted in collaboration with an academic adviser, later joined by a student counsellor. The diverse teaching team included two supportive tutors and an industry mentor.
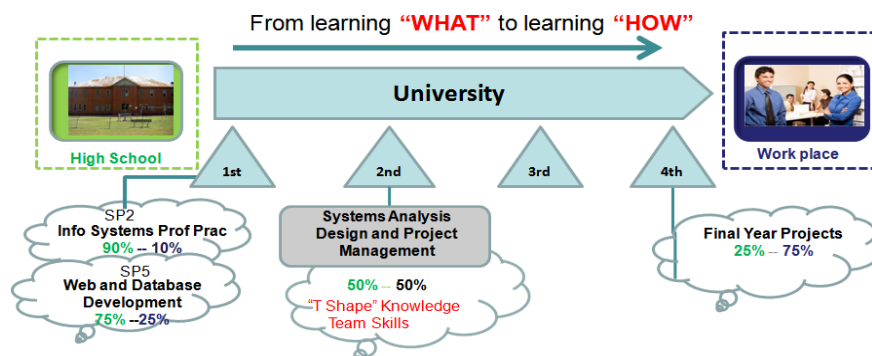

Figure 1: Linking Students to the Big Picture: the personal to the professional

This paper reports on the first cycle of the SADPM course. It explains the context, identifies the challenges faced by the teaching team, then outlines the teaching strategies, some findings and lessons learned. The curriculum is very much a work-in-progress.

The context

One mismatch between school leaver expectations and university realities is being required to work in groups (Jacobs, 2006, np), with first year students often assessed on skills they have not been supported to develop. They become understandably wary of group work, as early evaluation comments showed. "I used to be in a team, members are so lazy, at the end we finish the assignment but that is not a happy experience". Krylov's fable of the crayfish, the swan and pike, all pulling in separate directions, seemed apt.

The curriculum was developed with the Industry Mentor, to reflect industry desired skills. It aims to develop students' skills in systems analysis and design through the topics of project management (teamwork, estimation and scheduling, risk management, project monitoring and control). Assessment is 50% individual and 50% group work, with groups of 4-6 students working on allocated projects. Assignment 1, worth 15%, requires students to produce System Requirements Specifications (SRS) for the system operational concept given (OCD). In Assignment 2, worth 35%, the students demonstrate their knowledge in the System Design Document (SDD). Formative feedback on assignment one aimed to improve student marks in the second, which was aligned with and based on the first.

The challenges

Teaching students to become more inclusive communicators involves moving beyond discipline specific 'utilitarian pedagogy' (Patience, 2008, p.62) to an 'affective pedagogy' which encourages "students to move beyond their knowledge comfort zones' (ibid, p.55). This involves creating a learning space where students can engage with material, using their beliefs, attitudes, experience, culture and personality, a process which challenges students and teachers. Teaching inclusively involves substantive knowledge, discipline approaches, attitudes and values. The teaching team hoped to create something new, or transdisciplinary, by "embedding various streams of knowledge in one another" (Somerville, 2000, p. 285) rather than simply an interdisciplinary 'adding on'. As the tutors were not experienced in teambuilding, the academic adviser designed and conducted the first activities and collaborated with the counsellor for the tutorials on rank.

Developing systems requires students to develop "T-shaped" broad knowledge based on deep expertise (UK Report, 2007). Students often prefer individual work, where they feel in control of their grades. As Figure 1 shows, students must progress from individual to collective assessment, so the first activities focussed on bridging perceived social and cultural differences and creating team agreements. The counsellor then worked on how rank and power affect group interactions. Peer evaluation helps by assuring students that their marks are not unfairly affected by non-contributing

team members. It encourages those with higher rank, who usually take over, to allow others to be more involved and it encourages those with less rank to try.

Engineering students may resist new approaches because they involve 'threshold concepts' within the core concepts being taught (Meyer & Land, 2003; Male, 2011). Threshold concepts are 'critical' to students' progress, transformative in that they lead to permanent shifts in thinking about an issue and therefore often 'troublesome', since they can be 'alien' to previous thinking. This can lead to defensiveness rather than reflection (Segal, 1999). Acknowledging negative emotions is an important part of the critical reflection that marks a transformative journey (Morgan, 1987, in Taylor, 2000) for individuals and groups (Saavedra, 1995, in Taylor, 2000, p. 314).

Because students may take longer than one semester to appreciate challenging subjects, negative student evaluations may have a greater impact on innovating teachers (McDonald & Mills, 2007, p.26). Identifying causes behind student resentment helps to refine how to introduce threshold concepts, which increases students' sense of safety and reduces negative responses (Kelly, 2008). Guiding students through defensiveness into reflective opportunities (Segal, 1999) assumes awareness and skills many educators do not yet have (Badley, 2000). Not all lecturers are convinced it is important or part of their role.

Teaching strategies/methods

We scaffolded learning opportunities to guide students to develop and practise skills, as well as build relationships with peers. Table 1 below summarises what we did, why and how.

Results

We were surprised by the positive effect that better team collaboration had on the students' results. Figure 2 below shows a sample of results of all 149 students who worked in groups: (1) internal face-to-face groups, (2) pure virtual groups and (3) hybrid including external and internal students and who submitted both assignments. Figure 3 shows the results of individual projects completed by external students. Students working in teams (Figure 2) achieved significantly higher grades than those working independently (Figure 3) and their grades improved significantly between the first and second assignments. There is a significant shift towards better results HD and D and a significant drop in P1, P2 and F. Students working independently also tended to improve but less dramatically. For Assignment 1, the mean score was 65.04 with a standard deviation of 13.35 while the mean score on assignment two was 72.30 with a standard deviation of 10.74. The Wilcoxon signed rank test gave a Z result, ($z = -5.823$, $p = .000$). A t-test gave a similar value ($t = -6.810$ and $p = .000$). Interestingly the negative and positive ranks show that 46 students did worse and 8 did exactly the same, whilst 95 improved. The mean score difference for those with improved results is +14.9483 in contrast to -7.3783 whose marks decreased.

The Confidence Rater

The evaluation sheet included a Likert scale asking students to rate their confidence in team work from one, 'not confident' to five 'very confident'. Around 70% of the original sample did the final evaluation, which shows an overall increase in confidence. Those not confident or barely confident shrank from 24% to 14%, while the proportion that is confident has increased from 25% to 38%. About 77% in the original sample were quite confident to very confident. In the second sample, this has increased to 87%. This result is significant to 5% level.

One Minute Evaluation Responses

Short, anonymous evaluations provide rich, rapid feedback (Angelo & Cross, 1993). For example, there were 122 "things I have learned" comments from 81 students and 54 unanswered questions in Evaluation 1. They also help students to practise giving and receiving constructive feedback, as indicated in 'frivolous' comments ("why is the sky blue?") dropping from 15 in Evaluation 1 to nil in the final evaluation. The lecturer provided feedback in lectures and online.

Table 1 Interventions promoting participation and group work skills

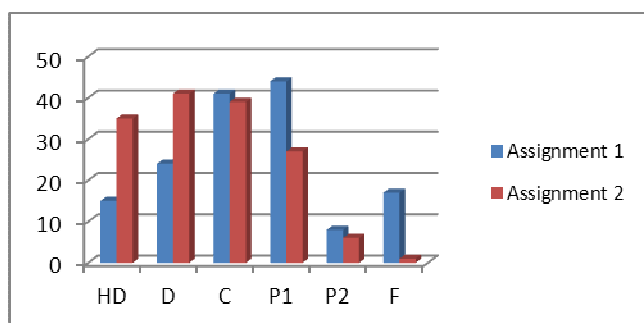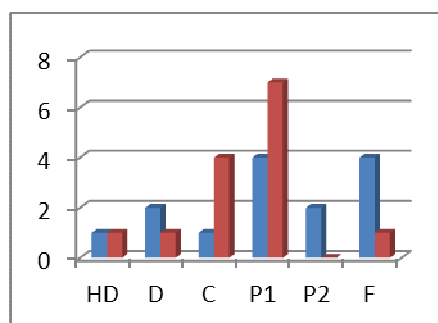| WHAT	WHY	HOW
Initiatives for students		
Teacher actively promotes: ➢ *Industry relevance* ➢ *Course participation – learning through experience* ➢ *Personal development*	• Promote relevance of Team Building for career and life • Support collaborative culture in the profession	• 1st lecture – lecturer introduction • Reminder when introducing tutorial exercises
Getting to Know One Another ➢ *Personal Profile Exercise* ➢ *People Bingo* ➢ *Negative Brainstorm* ➢ *Individual agreement "5 things I would like in a team..."*	• Multidisciplinary course • Need structured experiences to develop relationships • Teachers create an active environment • Identify causes of negative team experiences	• 1st lecture- personal profile + small group discussion Ist Tutorial (21 students) • (*Brainstorm as many attitudes and behaviours as you can that will guarantee teamwork will be a complete disaster and miserable experience for everyone.*) • Create positive alternatives
Rapid Response Team Building ➢ *Establish group agreements, roles and name* ➢ *Enter on Group Wiki – teams' centre point*	• Structured agreements scaffold learning experiences, create transparency • Enhances capacities to take responsibility	• 2nd tutorial – Groups decide team identity and aims • Use individual agreements
Peer Evaluation- by students ➢ *Students rate each other's contribution* ➢ *Assessment gradings weighted according to contribution*	• Encourages inclusive approach • Gives transparency about responsibility • Discourages a top down approach (*Students can challenge any who 'take over'*)	• Weekly evaluations using a template, including in-class and online group work participation
Understanding the effect of rank on communication ➢ *Behavioural Indicators of Rank* ➢ *Group Discussion about Rank* ➢ *Tutor support*	• The ease with which people communicate in a group depends on their rank in it • Making transparent the effect of rank on communication enables students to break through unquestioned communication patterns	• 4th week Lecture – Effect of Rank on Communication • 5th Week Tutorial – Individual Rank Rater to ascertain rank • Build student confidence
Initiatives between Staff		
Modelling Responsiveness ➢ *One minute evaluations* ➢ *Reciprocal feedback and action*	• Shift group dynamics to collaboration -listening/ responding • Academic staff modelled this: • Evaluations collated /on website Comments help shape course design • Weekly staff meetings - guide team building • develops constructive criticism skills	• One minute evaluation weeks 1, 7, 13. Students rate confidence in group work • Feedback in lectures Staff meetings - discuss progress, feedback, tutors' comments
Peer Evaluation by staff ➢ *Facilitated teambuilding skills workshop for the School of Computer and Information Science*	• Determine approaches used and rationale • Develop collaborative understanding of issues / acknowledge School expertise • Increase School interest and understanding about Rapid Response Team Building	• Mapped School approaches • Explained approach /facilitated discussion

Figure 2: Team project results

Figure 3: Independent project results

We used the students' evaluation comments to determine whether the students made either reflective or reflexive comments or chose not to engage. Reflective comments included "rank is considered important to how people contribute", "a person's sense of competency could be a result of rank". Reflexive comments included "I could be a leader if I put my hand up" and "be more aware of others in the group". Affective vocabulary also emerged in the final comments, for example, 'passionate', 'confident', 'aggressive', 'do not be afraid'. The English skills of many remain poor and need ongoing scaffolding and formative feedback opportunities across the program (Ferris, Sitnikova, Duff, 2010).

The percentage of students who engaged effectively with the Team Building experience rose from 78% to 87% across the two assignments. This was reflected in the higher grades they gained in Assignment 2. Interestingly, this percentage almost mirrors the increase in confidence figures. The higher percentage of reflexive comments in week 7 evaluation corresponds with introducing the material about the effect of rank on communication. Week 13 evaluation reflective comments showed deeper consideration of their team experiences.

Tutors felt the pressure. One wrote, "it felt like a year has passed while doing this course", but added that students "had fought many personal challenges…learned to deal with team members and improved their collaboration skills". Another found it an opportunity to "learn new teaching skills, including new techniques and challenges in interacting with international students". Tutors also reported major shifts in students' mindsets including a more considered approach to group work, reflected in the Wiki site meeting minutes; understanding that inclusive communication was a key to success; recognising the critical role of the Project Leader and using this rank to foster collaboration, while those of lower rank realised they had a responsibility to contribute.

Lessons learned

Increased confidence may not indicate increased capability. Students may become *less* confident as they realise what is involved in effective communication and their own need to improve. The next course will enable students to rate both their confidence and perceived capability in team skills. A simple pairing strategy will maintain anonymity but track individual changes over the semester.

We introduced rank and communication just before Assignment 1's due date and it would have been preferable during the group formation stage before the group agreements. We received minimal verbal response when we introduced rank in lectures and tutorials. One or two students were clearly uncomfortable with personal enquiry, and avoided the process. However, week 7 evaluation comments showed most were reflecting on material, even if they were not talking. Other student comments indicated that they believed thinking about relationships and reflecting on themselves, had little relevance to the course. This remains a challenge for many vocational students (Male, 2011, Kelly, 2010). As a result of this pilot study, team building strategies will be integrated more cohesively into next year's course design.

Conclusion

We are educating professionals who will face demanding ecological, social, political, economic and cultural contexts. There is no transformative education recipe you can apply and tick as 'done'.

Teambuilding needs time and it assumes skills and qualities that teachers may also have to develop. Course coordinators need to be brave and seek experts to help them to 'build in' teambuilding communication skills rather just 'add them on'. Ideally this work is collaborative, integrated into course design, progressive across study programs and regularly evaluated. Students' improved skills were reflected in dramatically improved project marks between assignments one and two as well as increased confidence and awareness of what it means to work inclusively in teams. This is a work-in-progress, but we hope it will encourage and support others facing similar challenges.

References

The Australian Association of Graduate Employers Survey Summary Report, (2011), High Fliers Research. Accessed June 8, 2011, from http://www.aage.com.au/images/documents/research/Exec%20Summary%202010%20AAGE%20Grad%20Dev%20Ret%20Survey.pdf

Angelo, T. A., & Cross, P. (1993). *Classroom Assessment Techniques: a handbook for college teachers* (2nd ed.). San Francisco: Jossey-Bass.

Badley, G. (2000). Developing Globally-Competent University Teachers. *Innovations in Education and Training International (IETI), 37*(3), 244-253.

Dowd, P. (2010). *University Engineering Education in Australia*. Accessed June 12, 2010, from www.sefi.be/wp-content/papers2010/keynote_lectures/Dowd.pdf

Ferris T.L.J., Sitnikova, E, Duff, A.H. (2010) Building Graduate Capabilities to Communicate Research and Plans Successfully, *J. Engng Ed.* Vol. 26, No. 4, pp. 891–899.

Jacobs, B. (2006). *Engineering Engineers – Big Questions, Little Questions* Accessed June 10, 2011, from http://www.ee2006.info/docs/17.pdf

Kelly, P. (2008) *Towards Globo Sapiens: Transforming Learners in Higher Education*. Rotterdam: Sense Publishers.

Kelly, P. (2010). Engineering: a civilising influence? *Futures, 42*(10), Pages 1110-1118.

Male, S., Bush, M.B., Chapman, E.S. (2009) Identification of competencies required by engineers graduating in Australia, In Proceedings of the AaEe conference, Adelaide. Accessed June 8, 2011 from http://uwa.academia.edu/SallyMale/Papers/561179/Identification_of_competencies_required_by_engineers_graduating_in_Australia

Male, S. (2011) *Today's relevance of feminist theory and gender inclusive engineering curricula to help students overcome thresholds in engineering education*. Paper given at 15th International Conference for Women Engineers and Scientists (ICWES15), Adelaide, July 19-22.

McDonald, J., & Mills, A. (2007, Wednesday, August 8). Flaws in the SET system. *The Australian Higher Education,* p. 26.

Oriel, J. (2011, Wednesday, July 13). Our world needs the humanities. *The Australian Higher Education,* p. 25.

Patience, A. (2008). *The Art Of Loving In The Classroom: A Defence of Affective Pedagogy*. Accessed 20 June, 2011, 33, from http://ro.ecu.edu.au/aijte/vol33/iss2/4

Reed, J. (2011). *The Mindset Revolution*. Accessed June 7, 2011, from http://www.babusinesslife.com/Tools/Features/the-mindset-revolution.html

Segal, S. (1999). *The Existential Conditions of Explicitness: an Heideggerian perspective*. Accessed 7 April, 2011, from http://dx.doi.org/10.1080/01580379902101105

Somerville, Margaret. *The Ethical Canary*: Penguin Canada, 2001.

Taylor, E. W. (2000). *Fostering Transformative learning in the Adult Education Classroom: A Review of the Empirical Studies.* Paper presented at the Annual Meeting of the International Conference on Transformative Learning (3rd), New York.

UK Report (2007). *Creating systems that work: Principles of Engineering Systems of the 21st century*, 2007, The Royal Academy of Engineering, London.

Acknowledgements