



Student perspectives on peer learning: from ‘genius friends’ to ‘learning twice by teaching’¹

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Peer learning, whereby students learn with and from each other, is an integral component of learning in a university setting, yet is rarely formally incorporated into the classroom. Team-Based Learning is an alternative to lecture-based instruction where the majority of class time is spent with student teams working on complex problems and where the majority of the unit assessment is based on team submissions. Phenomenographic analysis of student interviews in a Team-Based Learning unit reveals clear student appreciation of the benefits of structured peer learning, irrespective of individual student capability. Furthermore, the students see team activities as representing a set of ‘opportunities’, namely to: (1) demonstrate contribution to the team, (2) learn from the team, (3) teach other team members, and (4) develop superior team capability. Students who utilise the opportunity to learn from the team emphasise the identification of a highly capable individual (a ‘genius friend’) within the team. Students who utilise the opportunity to teach the team point to the teaching of peers as a means of consolidating and testing their own understanding. The highly-structured team activities inherent to Team-Based Learning, as well as a consequential peer evaluation scheme, are seen to be vital in harnessing the benefits of peer learning.

Introduction

The value of peer learning, defined by Boud et al. (1999) as “the use of teaching and learning strategies in which students learn with and from each other without the immediate intervention of a teacher”, is often underappreciated by university educators. Peer learning can yield significantly increased academic achievement, due in part to: (i) the development of skills related to critical enquiry and reflection,

¹ ‘To teach is to learn twice’: Joseph Joubert

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(ii) an enhanced self-assessment of understanding, (iii) an improved articulation of understanding, and (iv) accommodation of a broader range of learning styles (Boud et al., 2001; Cooper, 2002; Topping, 2005). Traditionally, peer learning at university is characterised by a lack of structure, with a tendency for it to occur predominantly outside the classroom. In addition, there is rarely an obvious motivation (related to assessment) for students with a depth of understanding to engage in peer learning. Here, however, we highlight that although participants in peer learning can often (but certainly not always) be superficially categorised as ‘peer learners’ or ‘peer teachers’, there exist benefits for all participants; to quote Boud et al. (2001), peer learning is “a reciprocal learning activity...(which) should be mutually beneficial and involve the sharing of knowledge, ideas and experience between the participants.”

In this study, we examine student perceptions of peer learning within the fairly rigid structure associated with the instructional strategy of Team-Based Learning. Specifically, we address the question: How do undergraduate Engineering students experience peer learning when immersed in a classroom structure where, to succeed, they must learn predominantly from their peers, rather than directly from a teacher?

Educational Context

The setting for this study is a small undergraduate Engineering unit at The University of Western Australia (UWA) over the period 2010-2013. The unit, taken by students in the Environmental Engineering programme, introduces students to the statistical techniques and sampling principles that are required to solve problems in Environmental Engineering using collected data.

Throughout the study period, Team-Based Learning was employed exclusively in the unit. Team-Based Learning (TBL) is an instructional strategy which harnesses peer learning and problem-based learning in the context of a novel assessment structure (see, e.g., Michaelsen et al., 2004). While TBL is theoretically-based, it is empirically-grounded and has a prescriptive implementation process. Teams of 4-6 students are assigned randomly and remain fixed

throughout the unit. TBL units take a modular form and represent one version of ‘flipped’ learning: fundamental content is learned through out-of-class readings and then both individuals and teams are tested on that content before each module begins. All class sessions are then used to solve complex, ill-structured problems that (ideally) cannot be solved by any individual team member alone. At the end of each module, teams are assessed on their ability to solve one such problem.

Importantly, peer evaluation is a significant component of the assessment mechanism (a typical example of which is shown in Table 1). At the conclusion of the unit, students must (anonymously) assign a peer evaluation score (from a fixed total score of n , where n is the student’s number of teammates) to each teammate. Students are asked to assign a score to each teammate in proportion to “the extent to which that person has been an asset to the team”. The average peer evaluation score received by each student is then used as a multiplier for all the marks received for team submissions. The mean peer evaluation score within each team is necessarily 1 and the standard deviation of all peer evaluation scores has been approximately 0.15 (such that 95% of all scores fall roughly between 0.7 and 1.3). Given that it is used as a multiplier for all team assessments, the peer evaluation score can profoundly impact a student’s mark for the unit; indeed, from the beginning of the unit, the importance of the peer evaluation score is emphasised. Students complete a ‘mock’ peer evaluation halfway through the semester but this is used solely for provision of feedback and not for assessment.

Table 1. A typical assessment mechanism for this unit

Submission Source	Assessment item	Weight
<i>Submitted by team</i> [†]	Tests on reading material	15%
	Submitted problem solutions	35%
	Field trip report	5%
	Total of Team Contributions	55%
<i>Submitted by individual</i>	Tests on reading material	10%
	Semester-long project	35%
	Total of Individual Contributions	45%

[†]The peer evaluation score of each student is used as a multiplier for all team marks received.

So, the majority of the assessment for the unit is in the form of team submissions (Table 1) and all team submission marks are modified by a peer evaluation score. These features of the assessment help to ensure, respectively, that students (a) are committed to the superior performance of their team and (b) are motivated to become important contributors to their team. In other words, the students have assessment-related motivation for acting as both peer teachers and peer learners in this unit.

Conceptual Framework

Peer learning

We view peer learning as a reciprocal learning activity which invariably occurs between students with different capabilities, knowledge and understanding, and can occur irrespective of the extent of this imbalance. We see taking the ‘peer teacher’ role as an integral part of the learning process, such that a student may be unable to fully grasp a concept without having to go through the process of discussing, explaining or teaching it to another. We therefore focus on the perceptions of students who play both roles in the peer learning experience, and posit that the optimal outcome of peer learning is one in which the capability of the peer group exceeds that of any individual in the group.

In investigation of how Engineering undergraduates at UWA sought help in understanding difficult concepts, Szymakowski (2013) observed a hierarchy, whereby peers with superior understanding (termed “genius friends”) were sought out preferentially to teachers and teaching assistants. This speaks to the value of peer learning amongst Engineering undergraduates and sets the foundation for this study to ask why the ‘genius friend’ is so readily sought out.

Phenomenography

This paper takes a phenomenographic approach to examine variation in the students’ experience of peer learning in this unit. According to Marton and Booth (1997), there are a limited number of qualitatively different ways in which people experience, interpret and conceptualise a certain phenomenon. The aim of phenomenographic inquiry is to describe these different conceptions, identify their

underlying meanings and examine the relationships between them (Orgill, 2002). These categories of description (which cannot be defined a priori; a fundamental principle of phenomenography is that they are generated by the data itself) are used to populate an outcome space, representing the full range of experience of the phenomenon. Phenomenography takes a 'non-dualist' position (see, e.g., Marton, 2000), where learning is seen to be “negotiated between learner and teacher such that there is a relationship between the knowledge and the people knowing” (Baillie and Douglas, 2014). It is therefore particularly appropriate for this study, which investigates the ‘mutually beneficial’ activity of peer learning. Phenomenographic analysis typically requires satisfaction of the following criteria:

1. That the categories of description are logically related, parsimonious (i.e. as few as are necessary to cover the critical variation in student experience) and hierarchical (Yates et al., 2012). For example, phenomenographic studies of student learning often define ‘higher’ conceptions as those involving a view of learning as “seeing something in a different way” as well as “changing as a person”. ‘Lower’ conceptions involve a view of learning as “increasing one’s knowledge”, “memorising and reproducing” and “applying” (Marton et al., 1993).
2. If face-to-face interviews are used as the primary means of data collection, that the interviews be semi-structured, with open-ended questions, to allow “exploring at greater and greater depths of thinking without leading” (Trigwell, 2000). The sample size should be sufficient to gather suitably rich descriptions of the variation of conceptions about the phenomenon of interest (Bruce, 1997).

Team-based learning

Several studies on the impact of TBL on student attainment of learning outcomes have been published in the education literature. The effectiveness of TBL as an instructional strategy is not for debate here, however. The focus of this article is to ascertain student perceptions of peer learning within the confines (and as an inherent feature) of TBL.

Objective

The objective of this study is to define the variation in student experience of a classroom structure where, to succeed, they must learn predominantly from their peers, rather than directly from a teacher. As part of defining the variation of experience, particular attention will be paid to differences between the perspectives of students with a depth of understanding of the unit content (i.e. those who tend to act more as ‘peer teachers’) and those of the students without that depth of understanding (i.e. those who tend to act more as ‘peer learners’).

Methods

Data were collected from one-on-one interviews with students in this unit between 2010 and 2013. In each year, interview subjects were selected from a pool of volunteers; subjects spanning wide ranges of individual achievement were selected non-randomly from the pool. Over the course of the study, 55 students were interviewed twice per semester (once halfway through the unit, and then again at the conclusion of the unit). Interviews were recorded and transcribed; transcripts were checked against the recording for correctness (especially of statistical and/or Team-Based Learning jargon).

Interviews were semi-structured with only a handful of questions (and potential avenues of subsequent investigation) prescribed; the structure of the interview was determined far more by the subject than by the interviewer, who tailored subsequent questions to the subject and situation. Due to the semi-structured format, the interview length was highly variable, ranging from 10 to 50 minutes. In elucidating the categories of description of the student experience of peer learning in this unit, interview extracts from several students have been collated in each case in order to describe the variation in the collective conception.

Categories describing the student experience of peer learning

Interview analysis reveals four categories of description of the student experience of peer learning in this unit (Table 2). They are all

represented as ‘opportunities’ that are unavailable to students in a traditionally-taught unit. The dimension of variation across these categories is the prioritisation of development of the collective capability of the team over individual benefits (that may or may not relate to assessment). This sets the basis for a hierarchical arrangement of categories, from the lowest priority given to developing team capability to the highest.

Table 2. Categories of description of the student experience of peer learning within the structure of Team-Based Learning

Category of description of experience of peer learning	The objective of the student in team activities	Position in hierarchy
1. As an opportunity to demonstrate contribution to the team activities	To demonstrate contribution to the team (not necessarily to simply <i>contribute</i>), an objective which may be tied to assessment.	Low
2. As an opportunity to learn from the team	To harness the understanding of team members in getting <i>their own</i> understanding to the level of the other members (to act as ‘peer learners’)	Moderate, but prioritises individual development
3. As an opportunity to teach teammates	To harness their own understanding in getting <i>each team member’s</i> understanding to the level of their own (to act as ‘peer teachers’)	Moderate, but prioritises team development
4. As an opportunity to develop a collective understanding that exceeds the individual understanding of all team members	To utilise the varying competencies of the team members to enable development of solutions of which no one individual was capable	High

Importantly, the data demonstrate that the student experience can progress through these categories (in either direction) as their individual understanding, their confidence and the team dynamic change. While these categories are not entirely mutually exclusive, students identify readily as ‘peer learners’ and ‘peer teachers’ within

the team and clearly communicate that their objective in team activities may change from one moment to the next.

Category 1: An opportunity to demonstrate contribution

For students who experience peer learning in this way, the desire to demonstrate contribution has two origins (example quotes from an interview are shown in Interview Excerpt 1). Firstly, there is a clear altruistic motive, where students are concerned about “letting the team down”. Secondly, the peer evaluation component of the assessment is a strong driver of student behaviour, and (from the beginning) students are aware of how their contribution is perceived by teammates. Consequently, we argue that a fair and consequential peer evaluation scheme is a necessary component of any unit that utilises peer learning in the classroom. Importantly, the motivation of students in this position appears rarely to be about their own understanding; their objectives in team activities are effectively disconnected from the material being covered.

Category 2: An opportunity to learn from the team

Students who experience peer learning as an opportunity to act as ‘peer learners’ communicate three important features that facilitate peer learning (Interview Excerpt 2). The first is the identification of a ‘genius friend’ (often the terminology used by the student) within the team. This team member is identified early, and tends to retain that status throughout the unit. The opinions of this student tend to carry more weight than those of the rest of the team (collectively); this student is ultimately seen as having the final say in matters of debate. Secondly, the importance of learning from a student (who “thinks like you think”), rather than a teacher, is highlighted; it is difficult to replicate this inherent benefit of peer learning in lecture-based instruction. Finally, students describe a lack of embarrassment in asking questions of a small team, rather than of a lecturer or of a larger class.

Category 3: An opportunity to teach the team

Students who experience peer learning as an opportunity to act as ‘peer teachers’ highlight two reasons underlying their desire to engage in peer learning in this role (Interview Excerpt 3). Firstly, the

capacity for teaching another to be both the ultimate test, and optimal means for reinforcement, of personal understanding is readily apparent. In the words of one student, “being able to explain it to someone else is the minimum level that I look for when I’m trying to learn something”. It is this recognition of teaching peers as a means of learning that has prompted the title of this paper; namely that ‘to teach is to learn twice’. Importantly, there is also recognition of the importance of an assessment-related imperative for students to act as ‘peer teachers’; the fact that the majority of assessment is based on team submissions provides students with the motivation to bring the understanding of teammates “up to speed”. This motivation is often lacking in unstructured peer learning activities.

Category 4: An opportunity to develop collective understanding and capability

Students who see this opportunity in peer learning are most likely to speak of collective behaviour of ‘the team’, talk of ‘team function’ and use the plural personal pronoun ‘we’, rather than speaking of individual benefits and behaviours (Interview Excerpt 4). They are the most likely to recognise that functional teams develop capabilities that exceed those of even the most capable individual. These students tend not to fully describe themselves as a ‘peer teacher’ or ‘peer learner’, but more as a facilitator of team development. Importantly, these students communicate that features of the problems (on which the team is working) can facilitate arrival at a superior collective understanding. Namely: (i) the task should not be ‘subdividable’ amongst the team members and should require constant discussion amongst all members, and (ii) the superior capabilities of the team are most readily demonstrated when addressing subjective, “higher-order” questions.

Discussion

Fluctuation in student experience

It is clear that, although the categories in Table 1 describe the variation of student experience of peer learning here, the student experience may be very fluid and students may fluctuate between categories (Interview Excerpt 5). These fluctuations may be driven

by, amongst other things, the student's perceived understanding of relevant concepts and changes in the team dynamic. The fluidity of the student experience is highlighted by the following excerpts, taken from two interviews with the one student. Importantly, she is cognizant of her fluctuation between categories.

Differences in experiences between students: Impact on individual learning

Certainly, one concern shared by many capable students regarding team-based assessment is that the team will “drag them down” (Interview Excerpt 6). Here, we compare perceptions of individual learning from students with a good understanding of the fundamental reading material (those who scored in the top 20% of the class on individual tests, Table 1) with those who did not have that level of understanding (those who scored in the bottom 20% on these tests). Responses to the question: “Relative to other units you have taken do you find Team-Based learning an effective way to learn?” for the students with a higher level of understanding (H1, H2) and those with a lower level of understanding (L1, L2, L3) are shown below. These responses demonstrate that students of all capabilities perceive the benefits of peer learning, even if those benefits might vary with student capability.

Importance of assessment and unit structure in promoting peer learning

This study demonstrates the importance of the assessment mechanism in promoting peer learning. Tellingly, there is no category of description in Table 2 pertaining to students using peer learning activities as an opportunity for ‘social loafing’. The peer evaluation component of the assessment is critical in ensuring that, at a minimum, students are using team sessions as an opportunity to demonstrate contribution and capability. That the majority of the assessment of this unit comes from team submissions promotes higher-order experiences of peer learning, as (by definition) team performance improves with the progress of its members up the hierarchy.

Summary

Here we have employed phenomenographic analysis of student interviews to describe the variation in the student experience of peer learning in a unit where assessment and class time are centred around team activities. The analysis reveals four categories of description, where the dimension of variation across categories is the prioritisation of the development of team capability over individual benefits. The categories, from the lowest prioritisation to the highest, represent views of team activities as opportunities to:

1. Demonstrate contribution to the team, which in some (but not all) cases is driven by a desire to receive positive peer evaluation.
2. Learn from the team, where the inherent benefits of learning from other students (who “think like you”) are highlighted. Students emphasise the identification of a highly capable team member (often termed a ‘genius friend’), whose views carry disproportionate weight.
3. Teach other team members, which is seen as the optimal means of reinforcement of one’s own understanding.
4. Develop team capabilities that exceed those of even the most capable team member. Students who see this opportunity in team activities tend not to fully describe themselves as a ‘peer teacher’ or ‘peer learner’, but more as a facilitator of team development.

Students demonstrate that their experience fluctuates through these categories over the course of the unit. Tellingly, students spanning a range of individual capability report the benefits of peer learning under this structure. Team-Based Learning is also shown to promote the benefits of peer learning by providing highly-structured team activities and (through assessment) linking individual performance in the unit to both individual contribution and to team capability.

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Interview Excerpts

Interview Excerpt 1: An opportunity to demonstrate contribution	
<i>Interviewer</i>	Do you feel engaged, and determined to understand the concepts of this unit?
<i>Student</i>	<p>(on “letting the team down”) Yes, mainly because, at least for me personally, I just hate the thought of letting my group down. You have a sense, not a sense of guilt...but because you are part of a team, you don’t want to let the team down so you feel like you need to stay on top of the work and come to class prepared so that the team doesn’t suffer because you haven’t prepared yourself. I don’t want the team to think of me as the person that doesn’t have any input and never studies outside class and has not helped the team.</p> <p>(on personal motivation) For me I guess I’m orientated on my results rather than what I actually learn in the units so I’m a lot more focused on getting a distinction rather than learning how to use Kendall’s Tau or something like that, but that’s a personal thing for me. But working in the group I also didn’t want to disappoint the group members or let them down, I didn’t want to turn up to a test and (have) someone ask me to do something and not be able to do it. So that was a motivator. In terms of wanting to learn the concepts, I guess that wasn’t really there that much (motivation), it was just more wanting to do well and wanting to help out my team which was the main motivator - learning the concept was just a by-product of that.</p>
<i>Interviewer</i>	Do you think there is anything about this unit that makes you learn more, relative to other units that utilise group work?
<i>Student</i>	<p>(on the importance of peer evaluation) I think it’s the very simple fact that it’s been assessed more stringently than in other group work, because we actually have to evaluate our peers at the end, so your peers will tell you what they think you have contributed. So they let you know what they think your contribution is to the group and so if you contribute more, obviously you get higher marks. If you don’t contribute as much, you get lower marks. So, I think that is incentive in itself to want to perform. I want to be helping, and being up there, and on the ball, and being a contributing member. And I think that the methodology sort of gives you that, you know, that extra push.</p> <p>At the start we didn’t really know who was good at what and</p>

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	everyone was maybe a bit scared to be either too dominant or too quiet because we wanted other people to think that we were contributing enough. If I'd come unprepared I probably wouldn't learn as much, but then again you would also get a bad rating from your group members about your contribution.
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Interview Excerpt 2: An opportunity to learn from the team	
<i>Interviewer</i>	Do you think there is a leader in your group?
<i>Student</i>	<i>(on identification of 'genius friend')</i> Obviously there are people who are smarter than you in the group, and, especially early on, some people know more than another person. Our team has a genius girl, she thinks, and then reflects, and then reacts quickly. She seems to be fairly well prepared, more prepared than others, and yes, she does take the lead a fair bit with assessments. People do sort of look to her to confirm whether or not their ideas are right or wrong. (On one problem), four out of five of us had pretty no clue. But she knew how to do it and told us all how to do it, so without her we all wouldn't have gotten the question right.
<i>Interviewer</i>	Do you think you ended up with a better solution than she could have come up with individually?
<i>Student</i>	Well, we wouldn't. She would have come up with the same (solution), but it helped us. If she was by herself it wouldn't have made any difference because she knew how to do it. But there is a need in the group for everyone to understand how to do everything. Whereas if you're in a group of friends and you ask a friend for help, it's not really imperative for them to teach you. In this unit, if (one person) doesn't understand something it's very detrimental to your team and it could affect your team result.
<i>Interviewer</i>	Do you teach each other?
<i>Student</i>	<i>(on peer learning as a different mode of learning)</i> Myself, I definitely get taught. In my experience, it's been quite good because sometimes you're not sure of an answer, and so the person that's working with you can help you to understand it from the student's point of view. They're just learning it as well; they're not a teacher, they try and explain it to you from the way that they think, which is probably going to be closer to the way that you're thinking yourself, compared to a teacher. But I've just come to realise that I've somewhat become reliant on other members and their knowledge, so I'd say it

	has also hindered me in some ways as well.
<i>Interviewer</i>	What difference do you see between group work in other units and team based learning in this unit?
<i>Student</i>	Actually learning the content as a group, whereas in other units, you have to learn the content and then come together as a group to apply it. So if you learn it, and you learn it wrong, it's a lot harder to relearn.
<i>Interviewer</i>	Relative to other units you have taken do you find team based learning an effective way to learn?
<i>Student</i>	<i>(on avoiding embarrassment)</i> Yes, it's much more effective. It's more interactive, and because it's a smaller group of people rather than a whole class, you feel less frightened to speak up and ask a question to a group of three or four people rather than in a whole entire lecture room. And being able to ask the same question over and over until it actually gets stuck in and you actually understand it - rather than just going up to a lecturer and asking it once and still not quite fully understanding it.

Interview Excerpt 3: An opportunity to teach the team	
<i>Interviewer</i>	What are your team's strengths?
<i>Student</i>	<i>(on 'peer teaching' as a means of learning)</i> I generally find that I try to give direction in the group. I try to analyse the question and determine what techniques we need to use and then someone else implements the techniques with the data that we have. I feel that personally, I have always been able to grasp things fairly quickly and it's, what's the word I'm looking for, it's just nice to know that if I then go and explain it to someone else and we both have it correct, it solidifies the knowledge and I know what I'm talking about, which means that I know in myself that I could do that or use that. So being able to explain it to someone else is the minimum level that I look for when I'm trying to learn something.
	I think all group learning ultimately helps you understand your work better, because you get to see it from another person's perspective, and I guess it gives you a different point of view and makes you think – it forces you to think and see whatever your team mate is saying is correct or wrong, and also forces you, I think, to re-evaluate your stand. We can absorb knowledge by teaching other students, so it's testing whether we truly understand it or not.
<i>Interviewer</i>	Is this different to other units?

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<i>Student</i>	Yes, to an extent. Sometimes groups like we have in (this unit), they loosely form anyway when you tend to study with certain people. But because you're not forced to do it, occasionally, well a lot of the time I don't have people to necessarily explain it to which means that I can't judge whether or not I've learnt it to a depth that is enough to pass an exam or to use in real life. It's a lot harder without the groups being automatically set up and arranged for you.
<i>Interviewer</i>	Which aspects of this unit are the most conducive to your own learning?
<i>Student</i>	<i>(on imperative to engage in peer teaching)</i> The fact that we're dependent on our group, so if any one particular member isn't doing too well, the rest of the group know (that) to get better grades, we need to pull him up so he can help contribute. It's not just a solo thing, it's team-based. So you need to work as a team, and any one member can contribute in a particular way, even if he's not too great. That whole fact in itself means that we have to help each other in order to do well as a group in general. So, that's what I find is the most conducive - that we can't leave any member struggling behind.

Interview Excerpt 4: An opportunity to develop collective understanding and capability	
<i>Interviewer</i>	When solving problems, do you feel that your team arrives at solutions that are better than any one team member could have come up with individually?
<i>Student</i>	<i>(on arriving at a superior collective understanding)</i> Having the team dynamic there lets you bounce off ideas off each other. I guess it's the multiple minds able to reinforce each other and complement one another in solving any one question. So you can get a more constructive conclusion, rather than just one person saying this is the answer - another person might have a different way of getting there, a better way of getting there, a faster way of getting there. We are forcing ourselves to rethink our own opinion because other people challenge you with their opinion and then you have to rethink to see if they are right or not. I think that immediate feedback you get is very crucial to learning because you then don't end up creating thought processes or habits that are wrong, because once they are created, it's a bit hard to change. When you come to a conclusion,

	<p>it becomes more holistic and I'd say it's a more accurate and more solid answer, for want of a better word. I would rather trust the results I got from team based learning than I would – a team (answer) is more reliable than the answer I get from an individual.</p> <p>Some of the simpler questions (like, find the value of this), I'm sure we could get them individually. But it's the higher order questions, when you're asked to analyse the reason as to why it is so - I think the more subjective questions are where you see that team decision is always better than an individual decision. When we did the last team assessment, the first question was similar to a practice question we had done, but it had a slight twist to it at the end. And I pointed that out. But no one (else) did. So if I hadn't been there pointing that out, then they may not have picked that up if they had just done it individually. But I also know, personally, that I probably wouldn't have come up with the answer by myself.</p>
<i>Interviewer</i>	<p>What difference do you see between group work in other units and team based learning in this unit?</p>
<i>Student</i>	<p><i>(on the importance of not 'splitting up' the problem)</i> Basically, all the other group work that I've done has involved a lot of writing and splitting the work up and designating "you do this, you do that", whereas with team-based learning in (this unit), we actually go through the process of solving the problem together. This is more working towards a common goal. Everyone has their different input and you work together rather than working as individuals. That way, you can see how other people think about the problem and then maybe look at it from a different perspective. I think it's a really positive thing, actually.</p>
<i>Interviewer</i>	<p>Do you think there are some people that are 'listeners' and some people that are 'leaders'?</p>
<i>Student</i>	<p><i>(on the importance of dual roles of peer learner and peer teacher)</i> Yes, definitely. But I don't think there's anything wrong with that, and I think that you need both of those kind of people in a group for it to function correctly. If you had a group where there were four people who are natural leaders, then there might be a little bit more... I don't know maybe not conflict, but a little more something...</p>
<i>Interviewer</i>	<p>Difficulty?</p>

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<i>Student</i>	Yeah, it might be a little more difficult. But I think you need both those types of people.
<i>Interviewer</i>	And how do you describe yourself, which role would you take in class?
<i>Student</i>	I wouldn't say I'm either of them all of the time, I think I'm probably... it depends on the situation. If there's (a problem) that I go "oh I know how to do this", and maybe no one else has started working on it yet or taken the lead, then I would. Or if there's one that I'm not sure about or I don't know, then I would sit back a bit and let someone else take control, and I'd concentrate on trying to understand the figures.

Interview Excerpt 5: Fluctuation in student experience

<i>Interviewer</i>	Do you feel engaged, and determined to understand the concepts of this unit?
<i>Student</i>	<i>(indicative of Category 1 experience)</i> So (early on) once we did the readings and our individual tests, we knew that, if you already understood what was going on, it was more of a drive to impart that onto people who didn't understand necessarily, because that way you could boost your team mark. And if you didn't understand then you really had to drive to be involved in the learning so that you could be a part of the team and that way they wouldn't mark you down necessarily on your contribution, even though you couldn't contribute because you didn't really understand. So it really depends on whether you understood it or not in the first place, but I think both of them contributed to the drive to understand, or impart that knowledge onto other people who didn't understand, and that all comes down to the marks.
<i>Interviewer</i>	Could you give me an example of a problem that you have solved?
<i>Student</i>	<i>(indicative of Category 2 experience)</i> We had a question to do with moving averages - we were given data and we had three different moving averages, and we had to assign which one went with which. One of them we all agreed on, but the other two we were 50/50 as to which one went with which, and we went through the definitions of both of them, we went through looking at individual points and whether that would account for one or the other, and we came to a bit of a consensus, which is not the way that I would have thought it had have gone, but it gave us the

	right answer. But it was only through the discussion of how the other team members got to their solution as to which moving average it was, that I could see their way, and they convinced me that theirs was a better reasoning than mine was.
<i>Interviewer</i>	Relative to other units you've taken, do you find Team-Based Learning an effective way to learn?
<i>Student</i>	Yes...it works really well for content understanding and application. The only problem that exists is if there are a couple of leaders that do all the work and then some strugglers who don't actually get brought into the group. So the problem comes from having leaders and followers.
<i>Interviewer</i>	Do you think you are a leader or a follower in your group?
<i>Student</i>	(indicative of experiences of Categories 2 and 3) It depended on the module. At least one of the modules I understood everything pretty much first up.
<i>Interviewer</i>	Which one, the first one?
<i>Student</i>	The first one, yes, it was something that I'd understood during high school anyway so to go through that again, I found it pretty simple. But in module two because I missed some of the classes I was definitely not a leader and I had to continually ask questions and try to get involved to help myself learn the unit because I was not as up to date as everyone else.
<i>Interviewer</i>	Do you think Team-Based Learning promotes a deep approach to learning?
<i>Student</i>	It can do. Again, if you are a leader, you'll have the deep understanding because you have to explain it to people, and if you don't have that understanding you won't be able to explain it to people, or you will explain it to people wrong and that will be reflected in your marks. And if you don't understand it, if you are a follower, it's about attitude. Again, if you get in there and ask, you're more likely to have a better understanding, maybe not necessarily deeper but at least a better understanding, because of the one-on-one (almost tutor style) of the group work. So if you don't get one tiny little section or something, just by asking one question you'll automatically gain a deeper understanding than you had before, but it may not be as deep as the leader's.
<i>Interviewer</i>	Do you feel that you need to learn in order to be able to explain to others, in case they don't understand?
<i>Student</i>	(indicative of Category 3 experience) I feel that

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	personally, I mean I generally have always been able to grasp things fairly quickly and it's, what's the word I'm looking for, it's just nice to know that if I then go and explain it someone else and we both have it correct it's solidifies the knowledge and I know what I'm talking about, which means that I know in myself that I could do that or use that. So being able to explain it to someone else is the minimum level that I look for when I'm trying to learn something.
<i>Interviewer</i>	How does your team work together?
<i>Student</i>	<i>(indicative of Category 4 experience)</i> I think we work really well together actually. We all take in different bits of the information and then help to form a full solution when we do problems. We all read the problem and assess it ourselves, and we bring up the way we would do the problem and we discuss that, and quite often there are some people who don't really know what we're trying to do and some people who do, and we come to an understanding before we start actually doing a problem, so work out which techniques to use, which things to implement before we start on any problem, and we come to an agreement with that through discussion, and if it gets to that point, voting.
<i>Interviewer</i>	Which aspects of this unit are the most conducive to your own learning?
<i>Student</i>	I like working in a team because I think that's what we're going to end up doing as engineers, and just learning to take everyone's opinions on board, and to discuss a problem without judging someone else's opinion, and then come to a consensus of the correct way to do something using a team discussion. It's going to work in any workplace that you will ever work in, and it's not something you can really teach by lecturing, it's something you have to have experience doing.

Interview Excerpt 6: Differences in experiences between students: Impact on individual learning	
<i>Student H1</i>	Yeah, I reckon team based learning is a great way to learn because any queries that we have, we can refer to our friends; in most other units we are just alone, in fact we barely talk to anyone in lectures or tutorials, so you're just left to the consultation periods that are given. But (here), the fact that you have a group means that you can almost

	<p>turn to anyone to clear your doubts. I guess it's the multiple minds able to reinforce each other and complement one another in solving any one question. So it helps us to correct our mistakes, if any, or correct our concepts and reinforce any concepts that we had correct to guide us in the right direction.</p> <p>I liked it more over time because, at the start, I was a bit doubtful on working in a group, because I didn't know whether my group members would help me out or end up dragging me down. (But) what I find is the most conducive bit that helps us to learn is that we can't leave any member struggling behind. As a unit progresses, you get to know your group members more, you see their capabilities, you not only get more involved in it, but you enjoy the unit. I almost kind of enjoy the class times.</p>
<p><i>Student H2</i></p>	<p>I think it does, because just by being able to communicate your understanding to other people, it helps you get a deeper understanding. I think it is mainly just the discussion. You know, of many different viewpoints. As I said, I find that easier to learn. That's just my particular way of absorbing information. At least, it helps me really <i>think</i> about ideas. Because I know in some cases with a particular topic that's not very interesting I'll try and take it in, but I won't really think a lot about it. I may just initially try to absorb (the material) and then not really go in depth with it. Whereas if you're discussing it, either someone is trying to explain it to you, or you're trying to explain it to somebody else - there is that time for it to really sink in a lot more.</p>
<p><i>Student L1</i></p>	<p>Overall, I do believe that Team-Based Learning is an effective way to learn. I can compare (another unit dealing with statistics) to this unit. I found that when I did that unit, the only way I would really learn is going to my friends and getting advice from them. And so that's why I feel that, in <i>this</i> unit, I am learning because I'm learning from other people and that Team-Based Learning has really helped me, because I haven't been achieving very well in the individual tests. Whereas in the team assessments, I feel a bit more supported with some of my ideas and I understand better what the team says.</p>
<p><i>Student L2</i></p>	<p>Most definitely, yeah. Because individually, you've got a bias towards your thinking, and you restrict yourself to what you think is right, and you are so set in your ways (that) you can't be proven wrong to yourself - but if someone else can</p>

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	<p>prove there is another way to do it that's better and everyone else can see (that), that's probably a better way to do it. If I was comparing it to pretty much any other unit apart from a unit that I was really, really, really, really interested in, Team-Based Learning is really good. The only subject that would probably trump it would be physics, but that's because I love physics. So it can't have been the passion for the subject, but it (Team-Based Learning) can definitely engage interest where initially there wasn't going to be any. Because the thought of a data collection and analysis unit just bores the life out of people. You see the unit description, it's like this is going to be horrible and, you know, it's probably my favourite unit this semester. I'm probably going to remember pretty much everything I've learned through (this unit) later on. I mean it's just in my head, it's just how I think about things. I'm always going to read problems carefully, I'm always going to read passages carefully, I'm always going to know how to use these analysis techniques, it's just something that we know how to do now. It's an added skill rather than a lesson that we forget.</p>
<i>Student L3</i>	<p>Yes, definitely I do. That was sort of one major thing that I realised going through my degree, was that you do learn a lot from other people and that you shouldn't try to, you know, keep all of your knowledge to yourself because unless you know everything, then you're not going to benefit yourself. So I think it is really important. And the fact that we had that opportunity to do it in class, it works a lot better.</p>