The role of institutional power in tutorless problem-based learning.
Students' interactional strategies for self-managing conflict in teamwork.

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INTRODUCTION

The capacity to work effectively in teams is fundamental within all fields of engineering employment. In 21st century engineering, technical subject knowledge is of limited value on its own and must be accompanied with these interpersonal skills as part of the full graduate package. Teamwork is particularly important where innovation and entrepreneurial knowledge are highly valued, and therefore, one of the primary duties of current university institutions is to fulfil these prime industry demands [1].

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Entrepreneurial competencies entail having knowledge of how teams work, as well as how they are managed, in order to be successful; whether in virtual or face-to-face environments [1]. Consequently, it is essential that students learn to work in alignment with their peers if they are to deal with the complex and unpredictable problems presented by the engineering world.

Problem-based learning (PBL) is a collaborative pedagogy said to enable the development of 'soft' communicative skills such as teamwork [2]. PBL provides the means to learn relevant disciplinary knowledge through the use of ill-defined and real-world problems, while supporting the development of problem-solving skills in different contexts; in turn, bringing about innovation [2]. Although, *how* PBL actually enables the development of these skills is not fully understood, as little research has examined PBL interactions at close range [3]. This is problematic, as it is critical that we gain insight into the true dynamics of student-centred learning if we are to determine pedagogical best practice. Interpersonal complications resulting from negative behaviours within teamwork, for instance, can undermine the success of PBL, so we must understand how students self-manage social problems (if at all).

Given its theoretical principles which hold that students must work collaboratively if they are to sufficiently develop solutions to the problem tasks at hand, it is important to examine the working patterns involved in PBL [3]. The present work specifically investigates how students deal with difficult – and often inevitable – situations arising in PBL tutorials. For instance, social loafing – one of the major complaints associated with PBL – can be extremely detrimental to team productivity if it is not managed effectively by group members [4]. Similarly, repeated disagreements can detract from the purpose of the PBL sessions themselves [5]. These negative teamwork behaviours are especially prominent issues here, given the focus on floating facilitator/tutorless PBL, where the self-regulatory skills of the students are more explicitly called upon [5]. Floating facilitator PBL is commonly used to overcome resource restrictions in educational institutions involving larger cohort sizes, and limited numbers of tutors. That is, where it is not feasible to have one 'dedicated' tutor per group, students are expected to function predominantly within a tutorless PBL tutorial environment.

In light of these aforementioned issues therefore, by exploring the PBL experience, the aims of this paper are to develop empirical research which illuminates how students self-manage group responsibilities and arising conflicts *without* the tutor being on hand to guide each stage of the process on their behalf. Detailed analyses be presented and their implications for teaching practice discussed, with the aim to establish mechanisms by which students can be supported better in future teamwork situations.

1 METHOD

1.1 Participants and data collection

33 students – comprising six groups – within a third year Chemical Process Design module at a UK university were video-recorded (60 hours footage overall) during PBL tutorials (three meetings per week for 10 weeks in total). Following informed consent, students were filmed in private university rooms, where non-intrusive cameras and microphones were situated around the workspace. As this was their first experience of PBL, students received a one-day training workshop in conflict resolution/group processes, prior to the commencement of tutorials.

1.2 Problem-based learning (PBL) approach

As part of the floating facilitator PBL model, tutor participation was significantly reduced. Instead, educational accountability was placed upon the students themselves, forcing them to adapt to different learning styles amongst the group, and to manage arising social conflicts; as they would in real-life [6]. For example, at the start of each PBL session, students had brief contact with a 'floating' tutor who provided them with instructional materials and answered any prominent queries. The tutor would then leave the room, only revisiting the group around the mid-point of the session to ensure students were on-track with their collective goals for the specific PBL case.

The groups received two new problem cases each week. Students were presented with authentic industry problems (e.g. a client brief requesting their expertise in the conceptual design of a power plant, alongside efficient environmental management). Although contextually unfamiliar, these problems were laced with subtle prompts to students' previous learning, and were open-ended to encourage creative thinking, as in conventional PBL [6]. As part of monitoring group progress – a primary concern, given the tutorless environment – students submitted reflective reports to the class leader on a weekly basis.

1.3 Analytical procedure

Through Conversation Analysis (CA) and the accompanying Jefferson transcription system (1.4), we were able to examine the naturalistic student talk at a fine-grained level [7]. In this way, the interactions could be considered from the necessary institutional lens (i.e. functioning within the educational environment) where student discussions were meticulously organised in line with implicit group norms (i.e. within the PBL community) [7]. In the present case of student-led PBL, we sought to elucidate how students managed their newfound learner autonomy, and how this impacted the mechanics of dealing with arising conflicts. The following extracts, therefore, were included in this paper as striking representations of the data corpus as a whole, in that students negotiated social challenges through intricate discursive strategies.

1.4 Jefferson transcription system [8]

(0.2) – Pauses in tenths of a second
CAPITALS – Louder than the surrounding speech
Underline – Indicates emphasis on speech
↑ – Indicates a marked rising in speech intonation
£ – Talk produced in a laughing voice
: – Extension of the preceding (vowel) sound
[– Square brackets indicate overlapping speech

2   RESULTS

One of the core expectancies of PBL is that its learners will arrive at tasks with diverse knowledge stances. Some level of disagreement, therefore, is necessary if the cognitive rewards of PBL are to be reaped, and if learners are to be socialised towards the realities of professional engineering communities. However, managing disagreements efficiently is complex, as students must finely balance their needs to pursue educational responsibilities (e.g. challenging and proposing alternative theories) *alongside* the interpersonal norms of the institutional environment (i.e. without damaging their position as a fellow 'team-player') [9]. If we consider extract 1,

we gain insight into the standard – and considerably longwinded – flow of disagreements throughout the student-led PBL meetings:

Extract 1. "IT says redo the calculations"

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1   John:    the problem is the lack of pump calculations (.) we don't know
2            which calculations to use-we don't-we don't know what's
3            a:ctually happening
4   Eva:     unless [the-yea:h
5   Conor:          [YEAH
6   Eva:     are we going off of this ((points at worksheet)) or are we
7            updating what's already filled in?
8   John:    no: we don't update ((points at Luke))        [right? are we?
9   Eva:                                                   [okay sorry
10  John:    because it says sum up the equations of the calculations
11           for the data sheet which is THIS ((points at worksheet))
12  Eva:     okay so we don't-we just have to look at they ones?
13  John:    maybe-that's what (inaudible) (.)
14  Conor:   IT says redo the calculations blah de blah de blah
15  John:    maybe we only have to-
16  Conor:   but then ((points at worksheet)) all I'm saying is it says-
17           I don't know if I: (.) if I've read it-differently but I got
18           the impression that these are like the correct answers-
19  Luke:    sh-she: said that once we do the calculations they'll put them
20           up so I thought we were just doing the bottom sheet
21  Conor:   should we read-I think it would probably be a good idea if like
22           one of us was to just read the whole thing so that we can-
23  Eva:     okay ((begins to read PBL case instructions aloud))
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In the opening lines, John first establishes the problem at hand ("lack of pump calculations", 1), making an explicit display of the whole team's shared uncertainty ("we don't know"; "we don't-we don't know", 1-2). In line 4, however, Eva begins to suggest the group may have more knowledge than John has proposed ("unless"), but in light of Conor's loudened overlap which confirms John's stance ("YEAH", 5), she withholds her turn, formulating only a minimal agreement ("yea:h"). Instead, by invoking the PBL worksheet in her clarification-seeking proffers ("are we going off of this", 6), Eva raises the possibility that the group may pinpoint valuable information through this reputable shared object; a strategy for reclaiming conversational footing [10]. Here, Eva caters to the social demands of the educational environment, rather than being the first – and only – member to disagree with the certainty of John's claims.

In line 8, John's responding turn ("no:") is accompanied by a pointing gesture towards group member Luke, coupled with two further hearer-specific appeals as means of strengthening his position ("right? are we?"). Whilst he receives no uptake from Luke, it is intriguing that Eva makes an immediate backdown ("okay sorry", 9), as though she is cautious of being perceived as too probing of John's stance, or perhaps orienting to the dangers of challenging such a dominant group member. Following Eva's apology, John works to justify his rationale in more depth ("because it says", 10), and as Eva did in line 6, makes direct reference to the tutor-provided PBL worksheet (11) to bolster his claims. Conor's interjection in line 14 follows a similar pattern ("IT says redo"). In this way, whilst they have not yet reached alignment in their thinking, they still function as a collective team, as opposed to engaging in more explicit confrontations regarding the group agenda.

Whilst the group members have been diplomatic with one another throughout, their continual preference for hedging around conflicting viewpoints has resulted not only in significantly lengthy discourse (e.g. recurrent overlaps and interjections) but has also undermined the development of a solid plan of action in carrying out the PBL case; a frequently arising issue throughout the corpus. Line 19, therefore, marks a pivotal point in their interactions. By invoking the tutor ("sh-she: said that"), Luke's utterances are particularly powerful, as it is difficult to overrule institutional authority, which demands that they should be "doing the bottom sheet" (20). Luke calls upon an expert knowledge source, and consequently, the group compromise on jointly revisiting the PBL worksheet instructions ("read the whole thing so that we can", 22). Throughout our examination of the data, students' reference to institutional power acted as a common interactional strategy for diffusing group disagreements. This is *not* to say that an immediate agreement was reached, but it allowed students to move on from dwelling on task setup for too long (a significant risk in student-led PBL), and to get back on-track with their educational business.

As we visit the second PBL group under exploration, the students are in the later phases of the semester and have experienced group member Callum's negative behaviours towards their teamwork for several weeks now. The main complaints made against Callum are his continual lack of contribution to the PBL cases, as well as his inability to engage in regular contact with his team members via the online discussion forum. During this time, the group have not directly approached the problem with Callum, opting instead for 'gossip talk' in his absence, coupled with – unsuccessful – face-to-face prompts to encourage his participation. In this current extract, however, the group dynamics appear to be considerably more strained than in previous meetings. These tensions seem to arise as a result of Callum's own discussions of what constitutes unfair group behaviours when referring to his work with another group in the laboratory class:

Extract 2. "They're just being really difficult"

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 1  Callum:  they're just being difficult … they WANT to meet literally
 2           every second day and they're just being really difficult (.)
 3           this week they should be fine though-it's just the tray dryer
 4           one we did
 5  Craig:   ↑AW tray dryer's (solid)-what do you love about it? the
 6           results are like ridiculous
 7  Callum:  =no they're not (.)
 8  Craig:   what ↑tray ↑dryer?
 9  Callum:  ↑what? tray dryer's great-tray dryer's the best experiment
10           going (.)
11  Craig:   NO: we're DEFINITELY doing different experiments-the results
12           took me ages
13  Callum:  YEA:H YEA:H it's not that difficult though
14  Craig:   WELL YEA:H but it TAKES you like: [four hours
15  Callum:                                    [just pull up Excel
16  Craig:   AW I'VE DONE ↑THAT£
17  Callum:  AW really?
18  Craig:   want to see my Excel sheet? it's MASSIVE£
19           ((Annie raises her hand to Callum))
20  Annie:   what would you (even) do with it?
21  Molly:   I'm a good chemistry girl£ (.) I don't know this
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If we look at Callum's opening utterances, we see how he positions the expectancies of his lab group (within another degree module) as being overly demanding ("being difficult"; "meet literally every second day"; "just being really difficult", 1-2). This was a commonly employed strategy throughout the data corpus, where negative evaluations of out-group members were displayed as means of fostering in-group cohesion. In making this assessment, Callum also references an experiment previously undertaken by the current PBL group ("tray dryer", 3) in an attempt to secure their agreement ("we did", 4), as though his peers share insight into the simplicity of this task, and thus, they too *must* understand how unreasonable his lab group are being.

Instead of appeasing Callum's requests for alignment, Craig's responding turn (5) marks a clear point of disagreement (the loudened "↑AW" token, which is raised in pitch) where he challenges ("solid" is British slang for difficult) Callum's claim that the tray dryer experiment is an easy one ("should be fine", 3). In doing so, Craig indirectly raises the notion that the frequent meetings proposed by Callum's lab group are in fact reasonable, given the complexity of the experiment. These points of disagreement are recurrent throughout the ensuing lines (7-18), and in turn, Callum's misalignment with the group consensus becomes more apparent.

This extract is an intriguing portion of data, as typically, each of the studied groups worked consistently to maintain their sameness with one another as part of being a unified team (e.g. extract 1). However, in line 15, following Callum's continued proffers in support of his stance ("just pull up Excel"), Craig emphasises his own direct experiences of the experiment ("I'VE DONE ↑THAT£", 16) as an assurance that he will not be swayed by Callum's appeals. This establishes a competitive culture ("want to see my Excel sheet? "it's MASSIVE£", 18), and Annie's eventual involvement in the conversation adds power in numbers; jokingly raising her hand to Callum (19) as though he has been overpowered by Craig, and then questioning the relevance of the spreadsheet ("what would you (even) do with it?", 20).

In summary, if we reconsider the opening lines of the extract, we see how Callum's utterances prove to be dangerous conversational moves. By criticising his "difficult" lab group, Callum invokes the implicit social boundaries in place within the current team (i.e. he is no position to make such claims when he is already under scrutiny for similar offences here). That is, given his poor track record in committing to the duties of the PBL group during the course of the semester, Callum makes himself vulnerable to criticism amongst his peers. However, it is important to note that, despite their 'othering' of Callum through their institutional superiority, the group members opt for laughing voices in their resistance, where – like the diplomatic approach of extract 1 – they recognise the necessity of face politeness.

3   CONCLUSIONS

By examining the above extracts in detail, we hope to have shed light on the complexities of student group interactions, as well as the need for continued qualitative analyses in determining pedagogical best practice for engineering. Although the tutor figure was absent for the vast majority of the PBL sessions, each of the groups within the data corpus demonstrated considerable adaptability to the unfamiliarity of the floating facilitator PBL model, drawing upon a wide range of discursive strategies in doing so. The students co-constructed the norms of the PBL community, where they adhered to the notion of team solidarity, and the need for continued discursive

politeness; regardless of arising social difficulties or negative team members. This was achieved through reference to institutional power (e.g. invoking the tutor/PBL worksheets), displays of humour, and longwinded discourse as means of mitigating more serious conflicts [10]. In this way, knowledge disagreements (e.g. extract 1) and unsatisfactory levels of member participation (e.g. extract 2) were addressed by the groups, but in such a way that they remained neutral in matters so that they could continue in their educational business.

Given the emphasis on teamwork within the engineering discipline, this study provides students with the necessary platform to engage in the realities of professional team scenarios, and in moving towards being accountable for their learning. However, in terms of the university where the current project is based – as well as many other UK institutions – PBL tends be implemented towards the end phases of the engineering degree, and as a result, this pedagogical transition can be difficult for students to adjust to. In light of this, the future aims of this study are to continue thorough analyses of these rich student interactions, where real-life data will then be used as authentic scenarios within PBL workshops in exemplifying what works – and what does not – in managing difficult group situations.

4   ACKNOWLEDGEMENTS

REFERENCES

[1] Vesikivi, P, Lakkala M, Holvikivi J and Muukkonen H (2018), Team teaching implementation in engineering education: teacher perceptions and experiences, *European Journal of Engineering Education*, Vol. 8, pp. 1-16.

[2] Dahms, ML, Spliid CM and Nielson JFD (2017), Teacher in a problem-based learning environment – jack of all trades?, *European Journal of Engineering Education*, Vol. 42, No. 6, pp. 1196-1219.

[3] Imafuku, R and Bridges S (2016), Guest editors' introduction: special issue on analyzing interactions in PBL – where to go from here?, *Interdisciplinary Journal of Problem-Based Learning*, Vol. 10, No. 2, p. 6.

[4] Aggarwal, P and O'Brien CL (2008), Social loafing on group projects: structural antecedents and effect on student satisfaction, *Journal of Marketing Education*, Vol. 30, No. 3, pp. 255-264.

[5] Woods, DR, Duncan-Hewitt WC, Hall FL, Eyles CH and Hrymak AN (1996), Tutored versus tutorless groups in problem-based learning, *American Journal of Pharmaceutical Education*, Vol. 60, No. 3, pp. 231-238.

[6] Duch, BJ, Groh SE and Allen DE (2001), The power of problem-based learning: a practical "how to" for teaching undergraduate courses in any discipline, Stylus Publishing, Virginia, pp. 40-42.

[7] Heritage, J (2005). Conversation analysis and institutional talk, Handbook of Language and Social Interaction, Lawrence Erlbaum Associates, USA, pp. 103-149.

[8] Jefferson, G (2004), Glossary of transcript symbols with an introduction, Pragmatics and Beyond New Series, Netherlands, pp. 13-34.

[9] Marra, M (2012), Disagreeing without being disagreeable: negotiating workplace communities as an outsider, *Journal of Pragmatics*, Vol. 44, No. 12, pp. 1580-1590.

[10] Day, D and Wagner J (2014), Objects as tools for talk, Interacting with objects: language, materiality, and social activity, John Benjamins Publishing Company, Amsterdam, pp. 101-123.