

Interpersonal affect in groupwork: A comparative case study of two small groups with contrasting group dynamics outcomes

Cheryl Jones¹, Simone Volet¹, Deborah Pino-Pasternak² & Olli-Pekka Heinimäki³

¹ Murdoch University, Australia

² University of Canberra, Australia

³ University of Turku, Finland

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Abstract

Teamwork capabilities are essential for 21st century life, with groupwork emerging as a fruitful context to develop these skills. Case studies that explore interpersonal affect dynamics in authentic higher education groupwork settings can highlight collaborative skills development needs. This comparative case-study traced the sociodynamic evolution of two groups of first-year university students to investigate the high collaborative variance outcomes of the two groups, which reported starkly contrasting group dynamics (negative and dysfunctional or positive and collaborative). Mixed-methods (video-recorded observations of five groupwork labs over one semester, and group interviews) provided interpersonal affect data as real-time visible behaviours, and the felt experiences and perceptions of participants. The study traced interpersonal affect dynamics in the natural fluctuation of not just task-focused (on-task), but also explicitly relational (off-task) interactions, which revealed their function in both task participation and group dynamics. Findings illustrate visible interpersonal affect behaviours that manifested and evolved over time as interactive patterns, and group dynamics outcomes. Fine-grained analysis of interactions unveiled interpersonal affect as a collective, evolving process, and the mechanism through which one group started and stayed highly positive and collaborative over the semester. The other group showed a tendency towards splitting to undertake tasks early, leading to low group-level interpersonal attentiveness, and over time, subgroups emerged through interactions both off-task and on-task. The study made visible the pervasive nature of interpersonal affect as enacted through seemingly inconsequential everyday behaviours that supported the relational and task-based needs of groupwork, and those behaviours which impeded collaboration.

Keywords: group dynamics; interpersonal affect; groupwork; socioemotional interaction; higher education



1. Introduction

While it is generally believed that engaging in groupwork in higher education prepares students for future teamwork (Curşeu et al., 2018), the relational realm of their social interactions (i.e., interpersonal dynamics) can be highly challenging (Näykki et al., 2014). As Bakhtiar et al. (2018) have argued, not only academic performance, but process outcomes such as students' interpersonal experiences, are an essential part of the collaboration picture given that perceived experiences influence attitudes towards future groupwork.

Research on groupwork learning processes has traditionally theorised social interaction in terms of the dual function of the cognitive for performing shared learning tasks, and the socioemotional for social (i.e., relational) performance (Isohätäälä et al., 2019; Kreijns et al., 2003). While such distinctions may serve analytical purposes, the interdependent nature of cognitive and socioemotional processes of groupwork are also widely recognised, although the inherently relational aspect has traditionally been a secondary focus for groupwork research (Baker et al., 2013). Yet, as Baker et al. (2013) note, for some students, the social can be particularly salient, and as students often struggle with the social dynamics of groupwork (Näykki et al., 2014) there is a need for better understanding these aspects through case studies that closely examine real time interactions in authentic group situations. Relying exclusively on post hoc individual self-report data cannot shed light on the social dynamics as manifest through the interdependent actions that unfold between participants. Further, the function of affect as inherently interpersonal phenomena in social interaction is often overlooked due to its pervasive and hidden in plain sight nature, yet as Barsade and Knight's (2015) review of group affect research has found, it is an important part of understanding the group dynamics puzzle.

The present research was grounded in a perspective of interpersonal affect as inherently social (i.e., relational) and dynamically evolving over time (Jones et al., 2021; Mesquita & Boiger, 2014) to examine the starkly contrasting social dynamics outcomes reported by two groups, each with four members, who were first year teacher education students undertaking a mandatory introductory science unit. The aim was to understand the function of interpersonal affect, as visible behavioural phenomena enacted by participants within their moment-to-moment interactions, and how it could explain the contrasting perceptions of the two groups regarding their group dynamics as negative, or positive. The following sections present the conceptual framework that guided the present study, and selected research in social, and educational psychology, that has empirically examined affect phenomena as social and dynamic in groupwork situations using dynamic methods (i.e., observations).

1.1 Affect as inherently interpersonal and temporally evolving phenomena in social interaction

Affect has traditionally been studied as individual (i.e., intrapersonal) phenomena incorporating a range of affective states, such as the preferences, attitudes, moods, affect dispositions, interpersonal stances, and emotions that individuals experience or express (Scherer, 2005, p. 704). The American Psychological Association, for example, defines affect as:

any experience of feeling or emotion, ranging from suffering to elation, from the simplest to the most complex sensations of feeling, and from the most normal to the most pathological emotional reactions. Often described in terms of positive affect or negative affect, both mood and emotion are considered affective states. (American Psychological Association, n.d.)

A paradigm shift in recent decades "from intrapersonal to interpersonal" perspectives, however, reflects growing recognition of the social nature of emotions (van Kleef, 2021, p. 91) and affect phenomena more broadly (Kuppens, 2015). Hess and Hareli (2019), for example, posit that even the most routine of everyday social encounters involve some emotion exchange, which acts as the "communicative signals" (p. 2) that coordinate social interaction (van Kleef, 2021), and which are often taken for granted due to their pervasive presence. According to philosopher Sheets-Johnstone (2009), affect in its most fundamental sense compels avoidance or engagement and can be seen as "responsivity,



a feature affectively characterizable as interest or aversion, hence as movement toward or away from something in the environment” (p. 376), and described variously in terms of unpleasant-pleasant, good-bad, positive-negative, and so on.

The nature of affect as interpersonally manifest and evolving over time in social interaction, is highlighted in Mesquita and Boiger’s (2014) *sociodynamic model of emotions*, which describes emotions as arising through interaction with others and serving an important role in cultivating the cohesion of the sociocultural contexts in which they occur. According to Mesquita and Boiger (2014), affect and social interaction “form one system” (p. 298) such that the affect (i.e., emotions; moods) that arises during social encounters is not reducible to an individual’s experience or expression; it is part of the interpersonal situation as it unfolds in groupwork.

This sociodynamic perspective highlights how affect is collectively cocreated (e.g., as group climate, conflict, or mood), as demonstrated in social psychology research that has focused on its visible nature in social contexts. For example, Bartel and Saavedra (2000) posited that for the relational effect of group mood to manifest it must be communicated in social interaction through visible *behaviours*. They demonstrated group mood as perceptible phenomena in 70 diverse workgroups using an observation instrument based on affect valence and activation, their observations aligning with participants’ self-reports. Barsade’s (2002) experimental study with university students then showed a contagion effect of affect as dynamically evolving in group interactions, in which a confederate enacted Bartel and Saavedra’s (2000) behavioural indicators. The relational effect of affect phenomena (i.e., as group mood, climate, tone) has subsequently been illustrated in education and workplace contexts (Barsade & Knight, 2015). As Slaby (2016) observed, “relational affect is often more a matter of specific modes of interaction - various ways of being- and acting-together in a situation, modes of joint or co-comportment - regardless of whether these modes of interaction assume the shape of a specific emotion type or not” (p. 8). Based on the above, the construct *interpersonal affect* was conceptualised in the present study as visible negative or positive behaviours in order to explore their manifestation, and function in the fundamentally relational realm of groupwork.

Studying the function of affect in social interaction also requires its conceptualization as dynamically manifesting and evolving over time (Kuppens, 2015). Reviews of the research on affect in groups have highlighted its dynamic temporal nature, such as the way in which affect during early group life has been shown to impact how groups interact and develop going forward (Barsade & Knight, 2015). Observational analyses of group interaction in collaborative learning contexts (e.g., Bakhtiar et al., 2018; Kwon et al., 2014) have found that socioemotional interactions influenced ongoing group interaction, including group learning processes. For example, observations of group interaction have found that negative socioemotional interactions can influence group learning processes over time, such as reducing task engagement (e.g., Näykki et al., 2014). Affect can also evolve as temporal interactive patterns. For example, Järvenoja et al. (2019) reported temporal interaction patterns in an explorational study of emotional regulation processes, which found groups exhibited three types of challenges – cognitive; emotional and motivational; social context and interaction – that evolved as temporal patterns in the absence of any perceptible collective emotion regulation.

More studies of groups’ real time interactions, that shed light on affective processes as they spontaneously arise and unfold are needed, as “collaborative learning is a temporally unfolding process, and as such, can only be captured as a series of interactions emerging over time” (Isohäätä et al., 2019, p. 833). Furthermore, observations of group interactions often examine episodes, such as socioemotional hotspots, emotion regulation processes, or interactions from one meeting, and studies that trace affect phenomena as they arise moment-to-moment and sequentially unfold over longer periods are also needed to explore how they emerge as collective, group-level relational dynamics.



1.2 Interpersonal affect and the importance of group dynamics outcomes

Recent studies on emotion regulation in collaborative learning have been instrumental in highlighting the pervasive nature of affect as innately interpersonal in groupwork, unveiling positive socioemotional behaviours that are important in supporting the quality of group learning processes. For example, widely agreed socioemotional behaviours found to support group learning, and which are innately relational, include providing *encouragement* (e.g., Bakhtiar et al., 2018; Isohätälä et al., 2018; Järvenoja et al., 2019; Kwon et al., 2014; Lobczowski et al., 2021), and displaying *respect* (e.g., Bakhtiar et al., 2018; Isohätälä et al., 2018) towards one another. Conversely, socioemotional behaviours found to hinder group learning processes include *undermining*, *rejecting*, or *overruling* others' contributions (e.g., Bakhtiar et al., 2018; Näykki et al., 2014). Groupwork often also involves socioemotional challenges such as participants' *anxiety*, and *frustration* (Järvenoja et al., 2019), and emotion regulation strategies that can have an unfavourable impact, for example *complaining*, or *venting*, which can spread among participants (Lobczowski et al., 2021). Research has also identified conflict emergence due to inadequate regulation of relational challenges, proving detrimental to task engagement (Näykki et al., 2014), and groups also often avoid the critical argumentation needed for problem solving in favour of maintaining positive relations (e.g., Isohätälä et al., 2018; Sohr et al., 2018). This suggests that participants can struggle balancing task and relational demands of collaboration (Näykki et al., 2014). Research on emotion regulation processes has thus shown the ubiquitous presence of affect and its important function in the quality of joint learning processes, and their deeply intertwined nature with the fundamental relational realm of groupwork.

Yet, as García et al. (2020) note, it remains the case that typically, “socioemotional interactions are studied in function of the results of the task and not as a phenomenon of interest in itself” (p. 209) and interactions not necessarily oriented to the learning task also warrant attention (Järvenoja et al., 2017). Thus, there remains much to be understood about the jointly manifested nature of affect phenomena in groups' social dynamics, and the subsequent impact of interpersonal affect on participants' subjective experience of these dynamics.

The importance of participants subjective experiences of their group dynamics was underscored by Bakhtiar et al. (2018, p.59) who argued that “although performance is commonly used as an indicator of productive collaboration, another important indicator is group members' perceptions of their experience, as these perceptions are carried forward as beliefs and knowledge informing approaches to future collaborative work.” In the present study, following Poupore (2018), groups' alternative negative or positive dynamics were conceptualised as outcomes on the grounds that the group dynamics of each meeting are viewed as micro-outcomes which serve as inputs to subsequent meetings, and critically, the self-reports of participants at semester end. Group dynamics can be broadly understood as:

The processes, operations, and changes that occur within social groups, which affect patterns of affiliation, communication, conflict, conformity, decision making, influence, leadership, norm formation, and power. The term...emphasizes the power of the fluid, ever-changing forces that characterise interpersonal groups. (American Psychological Association, n.d.)

According to reviews of the group affect literature (e.g., Barsade & Knight, 2015; Knight & Eisenkraft, 2015), understanding group dynamics outcomes requires examining affect phenomena. This was a key finding of Barsade's (2002) study, which showed that affect dynamically evolved over the course of a meeting, impacting the group dynamics of the experimental groups. Forsyth (2014) describes *group dynamics* as “the influential actions, processes, and changes that occur” (p. 2). In the present study, interpersonal affect is thus examined as influential actions (i.e., negative or positive behaviours) that unfolded at the micro-temporal level, and which evolved over time into macro-temporal interactive patterns that contributed to the groups' contrasting dynamics outcomes.

As the present study focused primarily on the relational (otherwise known as affective) realm, group interaction was extended beyond traditional task focus to incorporate off-task interactions. Kreijns



et al. (2003) argued that off-task interaction is typically affect-laden, less formal, and a space where people can establish relationships. According to Vygotsky (1978), the intersubjectivity that occurs in social interaction is fundamental to human relations (García et al., 2020) thus off-task interaction equally has relevance in understanding how the starkly contrasting groups intersubjectively cocreated their social understanding. Along this line, Barkaoui et al. (2008) adopted a Vygotskian perspective for their analysis of off-task interaction, arguing that all interaction, including affective (i.e., relational) interaction off-task, is germane to collaboration. Other empirical research has also shown that off-task interaction influences ongoing interaction. For example, in experimental research with university students, pre-meeting small-talk influenced ongoing positive socioemotional interactions (Yoerger et al., 2018), and in workplace teams, informal (e.g., sports, weather) chat was found to be infused with interpersonal affect that had a positive relational and task impact (Gorse & Emmitt, 2009). In the present study, which focused primarily on the relational realm of groups, all of the off-task interactions were therefore conceptualised as innately affective, as described further below in section 2.4 *Observational data coding*.

1.3 The present study

This study explored interpersonal affect, of two groups of first-year university students who reported starkly contrasting group dynamics outcomes (negative and dysfunctional; positive and collaborative). The aim was to examine the extent to which the two groups' contrasting perceived dynamics outcomes could be understood in relation to the visible interpersonal affect that arose and evolved in their ongoing interactions.

In the present study, off-task interactions were distinguished from those on-task to enable the exploration of how interpersonal affect in relational talk off-task may influence not only ongoing interpersonal affect, but also participants' evolving task participation given that learning was after all, the groups' *raison d'être* (thus foregrounding relational but not ignoring its task function). The present study therefore traced interpersonal affect, in a phenomenological sense *following* the participants' interpersonal affect in social interaction, in its natural fluctuation off-task and on-task.

Task participation was operationalised as participant/s contributing to the group task, evidenced through nonverbal and verbal communications (Isohätälä et al., 2019) or undertaking task functions (e.g., interacting with materials, with or on behalf of the group). Absence of task participation, in turn, was apparent by participant/s talking off-task. As groups naturally fluctuate between more or less informal modes, from spontaneous small-talk to task participation, the evolution of interpersonal affect is sequentially interwoven throughout the fabric of these two broad intersecting domains. Off-task and on-task interactions comprise the whole social context, expected to provide unique insights into the relational function of interpersonal affect as ontologically unfolding in groupwork.

Two research questions guided this study:

RQ1: How does interpersonal affect manifest and evolve over time in the off-task and on-task interactions, of two groups that reported contrasting group dynamics outcomes following their groupwork?

RQ2: What kind of interpersonal affect phenomena characterise the fluctuation of off-task and on-task interaction?



2. Methodology

2.1 Research design

This comparative case study (Yin, 2018) explored two small groups that were video-recorded undertaking shared science activities and then interviewed at the end of semester, yielding both external observations and participants' own perspectives. Following Näykki et al's (2014) suggestion, a comparative case study was used to examine moment-to-moment interpersonal affect behaviours that taken together, contributed to participants perceived negative or positive group dynamics outcomes. These kinds of everyday, hidden in plain sight phenomena are often only made apparent through contrast (Mills et al, 2012), and could contribute to better understanding interpersonal dynamics given that participants' perceptions of their group interaction influence their engagement in ongoing interaction.

2.2 Participants and context

Data for the study are a subset of a larger research project conducted within an introductory science unit for first-year teacher education students, in which the students were filmed during five groupwork labs. Twenty-two groups, spread across six different lab classes with different teachers, remained intact with their four members attending all classes over the semester (no natural attrition). Two case groups were selected as the focal point of this study, based on their starkly contrasting (negative or positive) self-reported group dynamics in their group interviews at semester end. Specifically, one group repeatedly expressed highly positive dynamics and an enjoyable experience, while the other reported salient negative events and ongoing interpersonal tensions. The two groups were from the same lab class, hence had the same teacher and lab conditions, limiting confounds potentially associated with different teachers, therefore making them highly suitable for this comparative analysis.

Group A comprised two females and two males, and Group B, three females and one male. Each group had one mature-aged student (over 25-years-old), and three under 25-years-old. The students self-selected into groups, however being a first-year unit, typically did not know one another well yet, and tended to form into groups as they were seated when instructed to form groups. Students were also asked to stay in their groups for the semester but could discuss with the teacher if they wanted to change. Participants were also advised that they could withdraw from the research at any time. Approval for the research was provided by the university's Human Research Ethics Committee and conducted in accordance with the national research code of conduct. Participants provided written consent for video-recordings and interviews. All names used are pseudonyms.

The research context was a science unit aimed to develop first-year student teachers' knowledge of fundamental concepts in chemistry, earth sciences, and physics, and understanding of scientific inquiry including practical experimental skills of planning and conducting investigations. Weekly lab activities consisted of one two-hour class, in which learning tasks were undertaken in small groups, using everyday materials for hands-on experiments. The groups were advised to work together (i.e., not to split but to work as an intact group on their activities). Details of the five labs' science activities can be found in Appendix A.

2.3 Data sources

2.3.1 Video-recorded observations

Of nine groupwork labs undertaken, five were video-recorded, filming the groups in their initial three weeks working together, then mid-semester, and their final group activity, providing a macro-temporal perspective spanning the semester. The teacher-instructed labs included collective hands-on experimenting followed by group science reasoning. Activities included shared planning,



experimentation, and conceptual reasoning. Almost eight hours (479.5 minutes) of video-footage of the two groups in five labs, were coded and analysed (see Table 2 for number of coded interactions and breakdown by off-task and on-task). The duration of coded observations for each activity ranged from 31-55 minutes.

2.3.2 Group interviews

Conversation style focus group interviews (approximately one hour with each group separately), were audio-recorded and transcribed. They elicited participants' feelings and perceptions regarding their groupwork. Although all participants were present for all video-recorded labs, one participant in both groups declined the interview.

Participants were invited to start the conversation with a general question asked to ignite discussion: "what would you like to share [with us] about your experience in the labs?" Then followed conversation that was inspired by a video-stimulated recall interview approach (Sherin, 2004). Video-clips were shown to stimulate informal discussion and directly tap group members' elucidations of their group interactions, followed by the question, "what would you like to say about this episode?"

2.4 Observational data coding

The video-recordings were systematically coded using the *Observer XT* behavioural coding software. A coding scheme was developed to exhaustively, and exclusively, parse group interactions into one of 18 discrete codes (see Appendix B) and trace visible interpersonal affect as concrete behaviours. (Data examples for each code are provided in Appendix C).

The unit of analysis was a discrete verbal behaviour (i.e., single utterance) or nonverbal behaviour. Coding was undertaken at the individual level as each participant could be enacting different behaviours (off-task or on-task) at the same time. The scheme was informed by a review of observational research in education and workplace contexts (e.g., Jones et al., 2021), with codes adapted from studies in collaborative learning (e.g., Isohäätä et al., 2019; Rogat & Linnenbrink-Garcia, 2011), and Kauffeld and Lehmann-Willenbrock's (2012) *Act4teams* instrument, which has been extensively validated in workplace and university contexts.

While only some on-task behaviours included visible manifestations of affect, with a positive or negative valence, all off-task behaviours were conceptualised as affective. Off-task codes were exploratory in nature to tap relational small-talk, humour, and laughter targeted to the group (i.e., positive interpersonal affect), or otherwise non-inclusive behaviours (e.g., whispered side-talk), conceptualised as negative interpersonal affect. The *Non-affective* category (fifth column of Appendix B) represents behaviours with no overtly obvious affective valence. The code *empty-talk* (adapted from Kauffeld & Lehmann-Willenbrock, 2012) was used 103 times of 6,500 coded behaviours (1.6%), therefore was excluded from analysis, as reviewing their occurrence suggested these instances did not impact group interaction.

The codes, representing broad interpersonal affect behavioural types, and valence, aimed to tap interpersonal affect as it occurs in the kinds of hidden in plain sight, everyday behaviours of social interaction, what Slaby (2016) referred to as the relational affect that is reflected in the ways we behave and act together in a situation, and which do not necessarily always involve expression of a particular emotion. In the off-task categories, for example, codes are generic (e.g., "small-talk", "humour", see Appendix B). Within on-task categories (positive, negative) codes have several behaviours (identified as salient affect behaviours in empirical research as discussed above) grouped together (e.g., "Abrupt, curt or rude behaviours; Interrupting to over-rule; Ignoring") as the aim was to denote the general type of interpersonal affect behaviours, and valence. For example, "Complaining; negative utterances" can be directed to objects, or the task, whereas "Criticizing/ running someone down" is clearly directed towards other/s, therefore a different kind of interpersonal affect.



Initial exploratory data analysis by the first author inspired a draft of the coding scheme, which was trialled with a second researcher (fourth author) from a dissimilar sociocultural milieu as we considered that researchers from diverse sociocultural contexts might contribute richly distinct viewpoints on interpersonal affect, and address observer biases. The trial process included joint viewing of video-clips, sharing conceptual and empirical understanding of events (Rogat & Linnenbrink-Garcia, 2013), then an iterative process involving individually coding test data followed by joint meetings, and further independent coding and comparison. Following, systematic coding including inter-rater reliability coding (Hallgren, 2012), was conducted.

To assess inter-rater reliability, a portion of each video was coded by two researchers (1,753 behaviours, 27%). Segments for inter-rater coding were randomly selected to comprise a portion from each lab for each group. The overall average interrater reliability produced a Cohen's kappa of $\kappa=.86$. By coding category, off-task agreement overall was $\kappa=.92$ (positive $\kappa=.90$; negative $\kappa=.10$). On-task agreement overall was $\kappa=.85$ (negative $\kappa=.82$; positive $\kappa=.85$). Table 1 lists the breakdown of inter-rater agreement by group and lab. Disagreements were resolved through discussion and repeated observations, and a small portion ($n=43$) of highly ambiguous behaviours were coded collaboratively rather than individually (Rogat & Linnenbrink-Garcia, 2013). These were typically in the on-task negative interpersonal affect category, and involved unravelling ambiguous episodes (i.e., several exchanges) that appeared to have some abrupt, curt or rude, behaviours in the context of the interactive flow, such as whether other/s had been deliberately, or inadvertently, ignored in discussion.

Table 1

Inter-rater reliability agreement (Cohen's kappa)

	Week 2	Week 3	Week 4	Week 7	Week 12	All labs total
Group A	.85	.92	.81	.90	.90	.89
Group B	.89	.76	.82	.75	.73	.81
Both groups	.87	.88	.81	.86	.87	.86

2.5 Data analysis

2.5.1 Frequency analysis

The coded data were exported from *Observer XT* for each group by lab, and their frequencies tabulated and analysed. The data analysis comprised three steps, which reflect the gradual zooming into the data, starting by focusing on the groups' interactions to identify the extent of off-task and on-task interaction. Next, moving to their interpersonal affect within interactions, the coded data were analysed by group, in each lab to develop a picture of the groups' evolutionary trajectories over the semester. The groups' evolutionary trajectories were analysed in terms of off-task and on-task interactions, and interpersonal affect, to highlight the emergence of interactive patterns over time, for each group. Then, the analysis focused on the breakdown of the visible behaviours that were coded as evidence of interpersonal affect in each group.

2.5.2 Qualitative analysis of interpersonal affect in the fluctuation of off-task and on-task interaction

The coded observations were then qualitatively analysed in the *Observer XT* by first temporally segmenting each of the ten videos (two groups in five labs), into 30-second segments with brief descriptive labels for an overview of the entire dataset for each group (Isohätälä et al., 2018; Näykki et al., 2014). The video-recordings were also transcribed in the *Observer XT*. An "elaborated running record" (Rogat & Linnenbrink-Garcia, 2013, p. 105) additionally documented salient nonverbal phenomena (i.e., orientation to other/s, eye-gaze, spatial and material use). Common episodes across groups were identified in each lab, which highlighted salient comparative events and evidence of interpersonal affect in the fluctuation of off-task and on-task interactions.



2.5.3 Qualitative analysis of group interviews

The interviews provided a perspective of interpersonal affect as the felt experiences of the participants, and their interpretations of their own and others' interactions regarding task and relational aspects of their groupwork experience. Qualitative content analysis of the focus group interviews (Huber, 2020) was conducted after the video-recordings had been coded and fully analysed in the above steps.

The analysis was undertaken in two phases. First, content of participants' talk was explored in terms of: i) members' own feeling states (negative or positive valence) expressed regarding relational aspects of their groupwork, or; ii) interpersonal perceptions about other/s (negative or positive valence) or about others' affect state/s; iii) negative or positive comments about the learning tasks; iv) negative or positive comments about task interactions; and v) perceptions of how they got on as a group. The interview transcripts were then explored for any other phenomena that may be insightful regarding the groups' interpersonal dynamics, such as whether participants exhibited agreement regarding their perceptions.

3. Results

3.1 Interpersonal affect in off-task and on-task interactions, by valence, and over time (RQ1)

The findings addressing the first research question are reported in three sub-sections, reflecting the focus of the three data analysis steps: interactions; interpersonal affect; and visible interpersonal affect behaviours. Two main group differences emerged, consistent with the self-reports of contrasting negative (Group B) and positive (Group A) group dynamics. First, interpersonal affect was overall more negative than positive in Group B, and highly positive overall in Group A; and, secondly, Group A's interactions both off-task and on-task exhibited minimal presence of the side conversations evident in Group B.

3.1.1 Interactions: by off-task and on-task, and evolution over time

The breakdown of off-task and on-task interactions overall is presented in Table 2, showing that off-task interactions comprised over 20% of all interactions, of each group.

Table 2

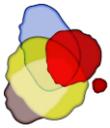
Breakdown of off-task and on-task interactions overall

	Group A Frequency (%)	Group B Frequency (%)	Total Frequency (%)
Total interaction	3,672 (100.0)	2,828 (100.0)	6,500 (100.0)
Off-task	1,124 (30.6)	628 (22.2)	1,752 (27.0)
On-task	2,484 (67.7)	2,161 (76.4)	4,645 (71.5)

Note: 1. The total of off-task and on-task does not equal 100% as *empty talk* was excluded from analyses due to evident minimal impact on group interaction and minimal appearance in both groups.

2. All off-task interactions were conceptualised as inherently capturing interpersonal affect.

3. Not all on-task interactions exhibited visible affect.



The presence of off-task interactions was found in both groups in every lab, with a remarkably similar temporal pattern in the frequencies off-task and on-task interaction across groups over the five labs, shown in Figure 1. This similarity suggests the presence of common contextual factors (i.e., the task activities) and therefore the need to look beyond task characteristics (Casciaro & Lobo, 2008) to understand what contributed to the starkly differing valence of the interpersonal affect across groups.

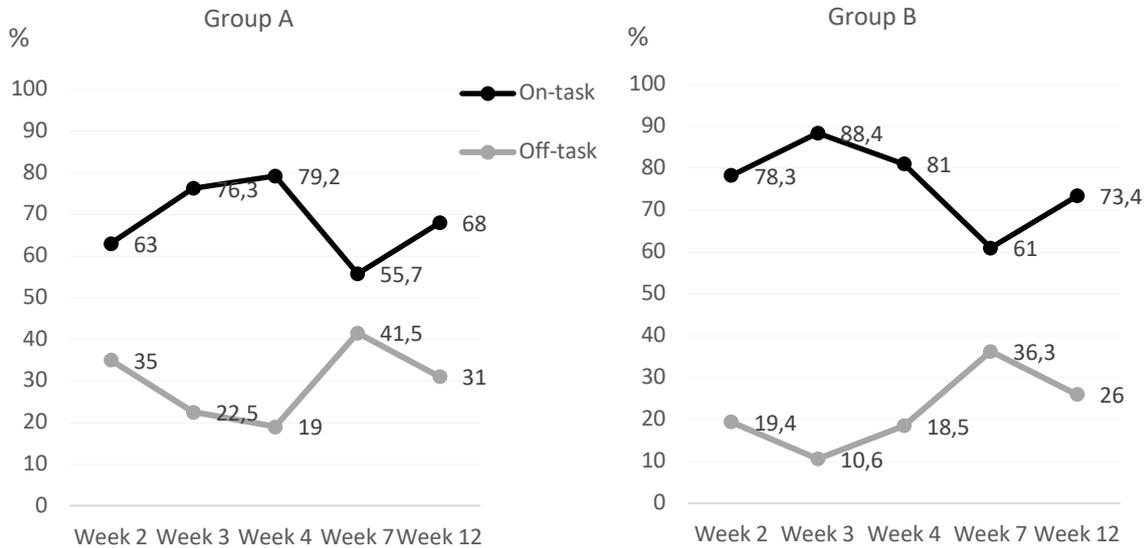


Figure 1. Evolution of off-task and on-task interactions over time.

3.1.2 Interpersonal affect: by valence, off-task and on-task, and its evolution over time

Concerning valence, the two groups were starkly different in their overall interpersonal affect, within both off-task and on-task interactions. As shown in the upper part of Table 3, Group A exhibited overall 91.0% positive and 9.0% negative, and Group B 47.0% positive and 53.0% negative interpersonal affect. These findings align with the two groups’ self-reports of their dynamics at semester end (reported later in section 3.3.3), suggesting that the visible interpersonal affect behaviours identified through the coding (reported in section 3.1.3) contributed to the groups’ contrasting social dynamics outcomes.

Table 3

Breakdown of interpersonal affect by valence overall and within off-task and on-task interactions

Interpersonal affect by valence	Group A frequency (%)	Group B frequency (%)
Overall (off-task + on-task)		
Positive	1,748 (91.0)	534 (47.0)
Negative	173 (9.0)	600 (53.0)
off-task	1,124 (100.0)	628 (100.0)
Positive	1,024 (91.1)	224 (35.7)
Negative	100 (8.9)	404 (64.3)
on-task	797 (100.0)	506 (100.0)
Positive	724 (91.0)	310 (61.3)
Negative	73 (9.0)	196 (38.7)



The breakdown of interpersonal affect by valence within off-task and on-task interactions is shown in the lower sections of Table 3. The findings for Group A are particularly striking, being almost identical for off-task and on-task (i.e., around 91.0% positive and 9.0% negative). In contrast, Group B display more negative than positive interpersonal affect overall (53%), and somewhat opposite findings across off-task and on-task, specifically, off-task being 35.7% positive and 64.3% negative, and on-task interpersonal affect 61.3% positive and 38.7% negative. The patterns of Group B suggest that here too interpersonal affect may traverse off-task and on-task.

Both groups exhibited more positive than negative interpersonal affect when on-task (see second last row of Table 3). However, off-task and on-task interaction could operate at the same time (e.g., member/s in *side-talk* and other/s on-task) and likewise negative or positive interpersonal affect could coincide, showing that the full picture of how interpersonal affect in off-task and on-task interactions intersected during groupwork is more complex. This is examined qualitatively in RQ2.

A temporal overview of the breakdown of interpersonal affect by valence within off-task and on-task interactions is shown in Figure 2. Within on-task interactions the breakdown by valence across labs shows a systematically higher percentage of positive interpersonal affect in Group A than in Group B but a relatively consistent pattern over time in both positive and negative interpersonal affect across groups. In contrast, within off-task interactions, both groups display noticeable fluxes across the labs, but for Group A it is in regard to their positive interpersonal affect while for Group B it is in regard to their negative interpersonal affect, with off-task interactions a relatively high source of negative interpersonal affect.

Of note, however, in the first lab, both groups' positive interpersonal affect dominated their interaction, especially off-task. Yet, Group B also *started* with around 5% negative interpersonal affect off-task and on-task (10.7% combined), which in the second lab rose slightly, and increased off-task thereafter. In contrast, Figure 2 shows Group A's negative interpersonal affect was 3.5% for off-task and on-task combined, and remained under 5% over time, with more positive interpersonal affect in both off-task and on-task interactions across labs. This begs the question regarding the interpersonal affect arising in early group life, and its potential function in the divergent dynamics of the groups over time, which is qualitatively explored in RQ2.

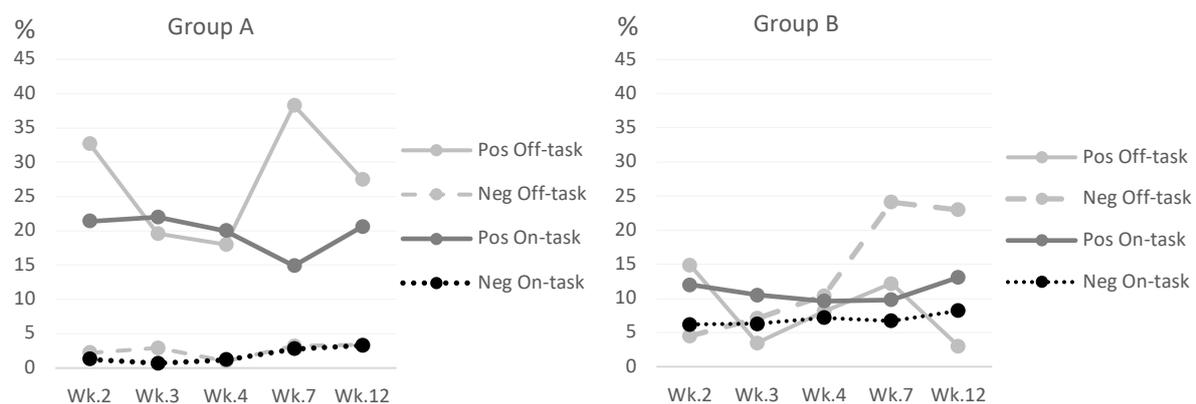


Figure 2. Evolution of interpersonal affect by valence in off-task and on-task interactions over time.

3.1.3 Visible interpersonal affect behaviours: by valence, off-task and on-task, and their evolution over time

Zooming in to the visible interpersonal affect behaviours of the two groups, Figure 3 presents a temporal overview for each group of their positive or negative interpersonal affect behaviours off-task.



(A full breakdown of the two groups' positive and negative interpersonal affect behavioural codes off-task and on-task over time is provided in a table in Appendix D.)

Regarding off-task interactions, the most striking group difference was the way in which Group A started, and stayed positive over time, compared with Group B. Figure 3 shows the difference between the two groups off-task (inherently affective relational interactions) regarding *side-talk*. Overall, this comprised half (50.3%) of all off-task interaction of Group B, compared to 5.6% in Group A. Side-talk is off-task chat that innately excludes member/s because its content is not inclusive, or due to its low volume (i.e., whispering), or corporeal positioning (e.g., turned away from other/s). Figure 3 shows that side-talk emerged in Group B's first lab (3.2%), increasing steadily over time to peak in week seven (18%). Its manifestation and evolution as a pervasive interpersonal affect behaviour over time in Group B, and its impact on group dynamics and task participation are examined in RQ2. In contrast, Figure 3 shows that in their first lab Group A exhibited a lot of positive *small-talk*, involving *humour* and *laughter*. Small-talk was relationally positive by its characteristics (e.g., content and volume were group-inclusive), and remained comparatively high in Group A over time. Group B's positive small-talk was far less frequent, with group-level off-task humour and laughter consistently lower and decreasing over time.

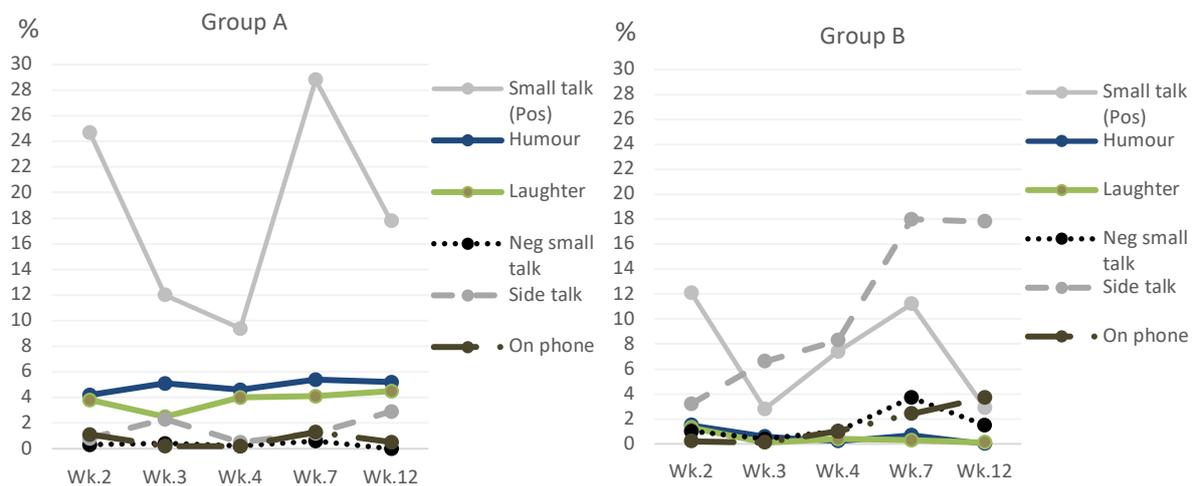


Figure 3. Evolution of visible positive and negative interpersonal affect behaviours in off-task interactions.

Regarding on-task interactions, as interpersonal affect was coded into five negative and five positive behaviours in on-task interaction, for clarity of presentation they are shown separately (Figures 4 and 5, respectively), for an overview of each group over the semester.

Scrutinising negative interpersonal affect behaviours within on-task interactions (Figure 4) reveals a key intergroup difference: the non-existence of splitting the group in Group A. In Group B, splitting was apparent in the first lab, but decreased over time. As side-talk showed a temporal increase (Figure 3), the possibility of a link between these two behaviours across off-task and on-task interaction is examined in RQ2.

Considering positive interpersonal affect behaviours within on-task interaction (Figure 5), across groups (although varying in frequency), efforts in *lightening the atmosphere* (e.g., task-related humour) featured most, and typically followed a similar pattern. In Group A, *laughter* closely tracked *lightening the atmosphere* over time, suggesting member/s responding to *lightening* contributions, such as responding to a task-related joke with laughter. In contrast, in Group B although *laughter* followed *lightening* at the beginning, it steadily decreased over time, but peaked in the final lab, suggesting there typically was not the same *response* to *lightening* contributions as in Group A.

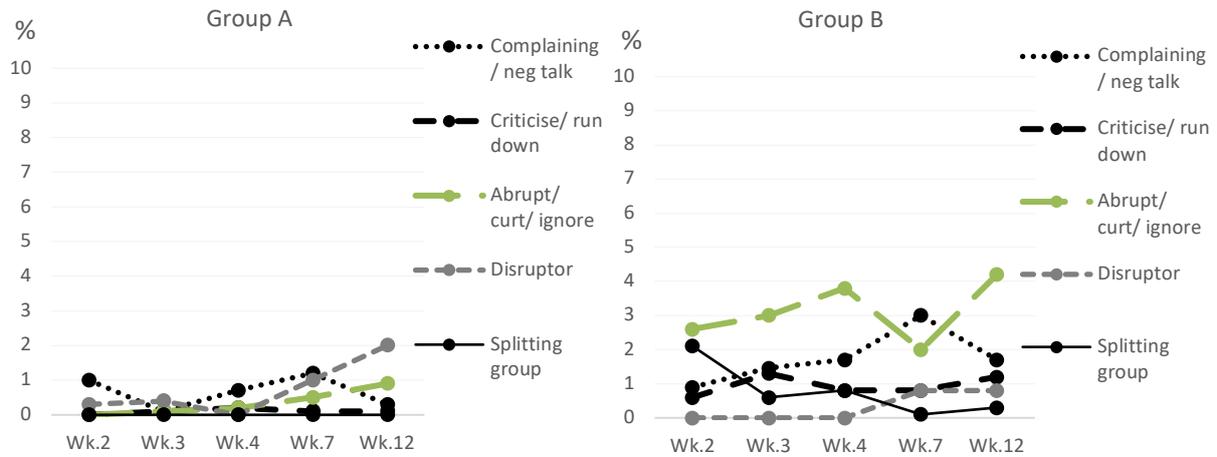


Figure 4. Evolution of visible negative interpersonal affect behaviours in on-task interactions.

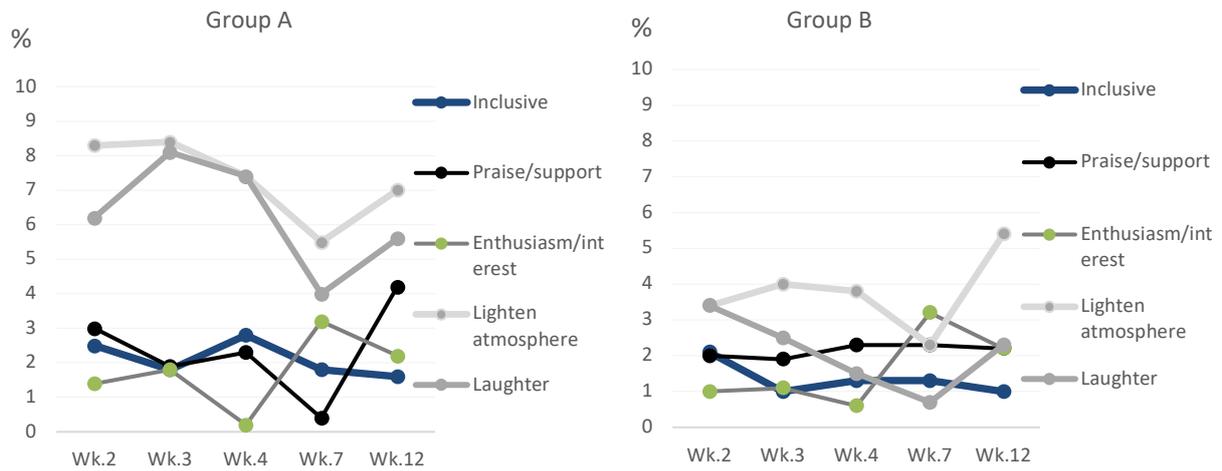


Figure 5. Evolution of visible positive interpersonal affect behaviours in on-task interactions.

In summary, an evolutionary perspective of interpersonal affect behaviours indicates that overall, Group A, both off-task and on-task, started and remained positive over time. In contrast, Group B started somewhat positive but the negative interpersonal affect evident from the beginning appeared to seed, increasing over the semester, most evident off-task. Overall, the coding analysis shows that interpersonal affect was pervasive across groups, with its valence transcending off-task and on-task interaction, in both groups. The presence of both off-task and on-task interaction took a remarkably similar pattern across groups over the semester, indicating the similar task conditions, and therefore the need to look beyond the task to explore the groups' different interpersonal affect trajectories, and contrasting dynamics outcomes.

3.2 Manifestation of interpersonal affect in the fluctuation of off-task and on-task interaction (RQ2)

Qualitative analysis explored how the interpersonal affect behaviours identified in the first research question actually manifested in dynamic interactions and contributed to the contrasting group dynamics outcomes reported by participants at semester end. The interplay of off-task interactions in



their natural fluctuation with on-task interactions was explored, focusing in particular on the contrast of side-talk (which was over half of all off-task interaction in Group B, and just 5.6% in Group A).

3.2.1 Developing social cohesion early

In their first lab, both groups started with a high task focus, with longer episodes of social (off-task) chat occurring late in the lab when students finished the task (e.g., they had cleaned activity materials away, and had stopped discussing their activity outcomes). Their first task involved preparation, and observations of two products (see Appendix A for task information). The following brief excerpts present each group's first moments, as they commenced. In Group B, one member suggested splitting to manage the task's two experiments. The teacher, overhearing, instructed that groups undertake the activities together:

Excerpt 1 Group B Initial interactions

Nick	Alright [<i>Standing as Teacher finishes explaining activities; glances to Nell, then to Lisa and Abby, who are talking quietly together</i>]
Lisa	[<i>Responding</i>] Alright, I'll get the stuff for Oobleck
Nick	I'll try silly slime, I'm no cook!
Nell	Well do we want to split in twos: two make the Oobleck and two make the silly slime?
Nick	Okay, good idea!
Lisa	No [<i>Frowning, mouth turned down</i>]
Nell	[<i>Responds to Lisa</i>] Or, make it all together?
Lisa	I don't want to miss out on making both of them [<i>Smiles</i>]
Teacher	[<i>Overhearing, tells the group, also reiterating to the class</i>]: No, make it all together

Group B thus started amicably, as did Group A, yet subtle differences were apparent:

Excerpt 2 Group A Initial interactions

Eric	Alright [<i>Standing as Teacher finishes explaining</i>]
Anna	Let's go!
Eric	Yeah? Let's go grab the stuff [<i>All four stand</i>]
Anna	Okay. I'll grab the playdough
Eric	Take that over there so we can just check it [<i>points to lab manual</i>]
Anna	Yep
Eric	<i>Singing</i> : Check yourself before you wreck yourself [<i>as they go together to the materials table</i>]

Group A commenced similarly to Group B with Anna saying, "I'll grab..." but to which Eric immediately responded, "so we can...check...", which subtly adjusts the materials gathering as a collective process. A few minutes later, they returned together with materials for their first product, and subsequently together collected materials for the second activity. In Group A, the collective start provided task affordance for group relational development (i.e., social and task cohesion). This was evident in the way that each product's preparation involved all members working together, with relatively high on-task humour and laughter (see Figure 5) that involved all four participants.

Conversely, Group B participants returned separately in dyads a few minutes apart, each with a tray of materials. They commenced working collectively (therefore not coded "split-group"). Yet, embedded in their language was an implicit reference to dyadic ownership of product preparation (i.e., the two activities), which they all expressed. For example, Nell: "Did you guys get the kettle water?" "Lisa: No. Ours is just normal water;" Nick: Oh, we needed hot water;" Lisa: "Shall we do yours first?"



Abby: “Are we doing ours yet?” Accompanying these kinds of comments, a *split-group* also emerged occasionally, as Lisa quietly discussed on-task with Abby, sometimes subtly resisting Nick’s contributions. For example, at the beginning of their first lab, Nick extended his arm to assist Lisa, who was mixing some of the materials she and Abby had collected. Lisa tells Nick that she just needs a spoon, and he immediately dropped his arm. Lisa’s manner is not overtly curt, but nor is it inclusive (coded conservatively *Task NA*) and these kinds of borderline interactions became the norm in the group (e.g., “yeah wait”, “hang on”, “Just read the-!”, “You’re reading the wrong one!”).

In the second lab, latent dyadic subgroups emerged again in Group B, with Nell requesting Nick assist gathering materials, while Lisa and Abby sat chatting off-task for five minutes, making no move to join the task. There was also no attempt to include them, thus the latent dyads of the previous week were tacitly endorsed by all participants, their pattern of commencing labs with off-task and on-task dyads continuing over the semester. In contrast, Group A collected materials together, side-talk was usually brief, and interactions were characterised by positive interpersonal affect such as small-talk involving humour and laughter that was group-level (i.e., involved all four members). A qualitative difference between the two groups regarding their off-task interaction, distinguishing side-talk in Group B from the small-talk typical of Group A, was its low volume, and (generally the same) side-talkers, sometimes turned towards one another exclusively.

Group B’s split group on-task and side-talk off-task characterised early low social cohesion. This appeared to create procedural confusion with at times two dyads interacting separately, sometimes not knowing what the other was doing or saying. Within this context, occasionally other negative interpersonal affect behaviours arose (e.g., highly directive interactions, ignoring) as member/s tried to ascertain what had been done, where they were up to, and so on. In this way the dyadic interactions contributed to the overall group dynamics, not only as non-cohesiveness but also an undertone of tension that occasionally surfaced as the visible negative interpersonal affect behaviours reported in section 3.1. This established the basis for ongoing interactions and highlighted a key group-level relational difference between the two groups, whereby Group A for the most part interacted as a group, and Group B interacted increasingly in dyads.

3.2.2 Interpersonal affect in the evolution of group dynamics and task participation over time

The analysis of the interplay of interpersonal affect in the fluctuation of off-task and on-task interaction over the semester highlighted another key difference between the groups in how each group’s interactive dynamics evolved over time. *Group-level attentiveness* to one another was consistently evident in Group A. In contrast, in Group B, *low attentiveness* to one another *as a group* appeared exacerbated by subgroup emergence. The contrast in group-level interpersonal attentiveness is illustrated in the following brief excerpts from week four, in which groups had to plan, conduct, and document an experiment. The first excerpt is characteristic of Group B’s communication:

Excerpt 3 Inattentiveness in Group B

Nell	So, what’s our hypothesis? [<i>Reading aloud from lab book as Abby was verbalising a hypothesis, which Nell ignores</i>]
Lisa	Missy here- [<i>signals that Abby has a hypothesis</i>] here, just, go on! [<i>encourages Abby to continue. Nell glances briefly at Lisa, then to Nick, who is writing</i>]
Abby	Briefly laughs [<i>appears shy, quietly spoken, looking down at her writing</i>]
Abby	The more we increase the vinegar the ... [<i>starts reading hypothesis again; Nell ignores Abby, looks to Nick</i>]
Nick	If we increase the vinegar volume the reaction...decrease [<i>Abby stops speaking as Nick speaks</i>]
Nell	The quicker the reaction rate
Nick	Yeah. The reaction rate should quicken



Following these interactions, Lisa and Abby had a brief, quiet exchange. In Excerpt 4 below, Group A had discussed and agreed their experiment, then Sam suggested an alternative, but without justification. Using science reasoning, Eric and Anna opposed the idea, to which Sam remarked “yeah, okay”, looking downwards, and becoming quiet. A few minutes later, Eric appeared to take responsibility for group harmony, checking if Sam was happy with their decision:

Excerpt 4 Attentiveness in Group A

Eric	Are you happy with that Sam?
Sam	Yeah, I just don't know how you'd- It should be alright, it should be alright
Eric	What's your question?
Sam	How long it will actually be in the air though...to get a good measurement. We can give it a go and then we'll find out
Eric	... we've got the trial
Sam	There's only one way to find out anyway so, as I say [<i>emphasizing his contribution</i>]
Anna	Yeah, let's just trial then modify

Here, Eric exhibits interpersonal attentiveness, as Sam had been quiet and appeared withdrawn as he looked downwards and stopped interacting with the group for almost two minutes (1 minute, 54 seconds). During this time Eric continually made task-related jokes (*lightening the atmosphere*). After asking if Sam is happy with the group decision, Eric showed further interest in Sam's thoughts: “What's your question?” Following, Suzi initiated an off-task relational episode, which appeared to reweave the social fabric of the group. This was evident by all members engaging in the talk and sharing personal information. Later, in a similarly challenging episode, another off-task relational conversation followed.

The excerpts are characteristic of each group's myriad, fleeting yet pervasive behaviours of interpersonal affect that together cocreated each group's social space, illustrating how Group A participants routinely exhibited interpersonal attentiveness. Conversely, Group B participants unintentionally, and deliberately, ignored (i.e., inattentiveness) one another. The analysis revealed the way in which interpersonal attentiveness, highlighted by its consistent presence in Group A and its relative absence in Group B, was a subtle but relevant form of positive interpersonal affect in the groups' face-to-face task interactions.

The groups' contrasting interpersonal affect was further emphasized later in the semester in week seven when an off-task peak across groups (e.g., see Figure 3) occurred. According to conversation across groups, this appeared due to a combination of two broader contextual factors. First, students had just returned following their first practicum, which permeated off-task conversations. Second, the task (electrical circuits) was considered challenging, stated by teachers and students alike. In group B, after initially working as a group, the subgroups emerged with one dyad increasingly off-task and the other on-task, and tensions surfaced (e.g., Lisa: “she doesn't want my help, I'm not smart enough for this”, Nell: “What? Well, you're more than welcome to try!”). In contrast, In Group A, although there was also uneven task participation with two members doing the lion's share of making electrical circuits, the group typically engaged together more in small-talk while exploring with the electrical circuits.

Summarising, the qualitative analysis showed how interpersonal affect behaviours in the interplay of groups' off-task and on-task interaction in early group life evolved into their diverging relational trajectories (group dynamics) and task participation. Specifically, in Group B, the early appearance of side-talk off-task and splitting the group on-task, although minimal in the first lab, evolved as an implicit interactive (social) norm, and in contrast, Group A started, and stayed positive and intact as a group.

3.3.3 Self-report interpretations of groupwork experience

The groups' overall negative or positive interpersonal affect extended into the focus group interviews, and Group A expressed being “lucky” regarding their positive experience of their



groupwork. Group B members, complaining about their groupwork experience reported that researchers would see plenty of off-task chat, summarily dismissing the frequent side-talk (e.g., explaining that they “just like talking while doing our work”). Overall, Group A’s self-reports largely aligned with researchers’ observations. Group B members reported negative experiences, which aligned with the observational data, but also displayed lacking awareness regarding their own behaviours in cocreating the group’s social dynamics.

Group A commenced with a focus on their learning experiences, agreeing that the experiments were fun, but the conceptual reasoning highly challenging. This involved each group discussing and producing a group reasoning statement linking their observations and results of experiments using everyday household materials, with the relevant science concepts. Group A participants discussed how their group context supported their science learning through this activity. For example, Anna: “I think at the beginning I felt really nervous” but members were “bouncing ideas off each other...I think the confidence came from the groupwork and actually just, having fun.” The others agreed, suggesting that Suzi too (absent from the interview) had enjoyed their groupwork.

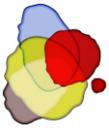
Watching video-clips of their final lab, they commented on their task participation, Anna reflecting, “it was good that we all contributed...”, Eric agreeing: “Yeah. You can see that everyone’s really involved...it was good.” They explained how over the semester they engaged everyone by rotating critical task elements including turn taking with leading the conceptual reasoning talk and documenting their joint reasoning statement, Sam noting, “I think by the time we started rotating we were all pretty comfortable with each other.”

Participants discussed their positive interaction off-task, which Anna believed had supported her learning: “For me...the contact of the group...we had a little chat and then we got into it...”, adding that it had changed her negative perspective of groupwork. They all reflected that their interactions off-task enabled them to relate well across the age-divide through showing reciprocal interest in one another’s diverse leisure pursuits, thus revealing how they utilised the affordances of off-task chats to bridge their individual differences. The oldest member praised his peers as “champs” in this regard which meant that the group members “were able to relate and talk about things other than just science”, noting awareness of the discord other groups experienced.

In contrast, Group B participants commenced with “Where’s the smart one?” (Nell) referring to Nick who was absent, then briefly mentioned that they all “hated” the conceptual reasoning and moving swiftly to the relational realm: “It’s hard work being in groups” (Nell). Lisa and Abby discussed how they liked chatting (off-task) as they worked, saying “that’s just what we do” (Abby), which they perceived Nick disapproved of (what they referred to as “gossiping”) and so ignored them. They suggested Nick was too task-focused (Nell: he’s like nuh, it has to be all science). Yet, their first lab together also shows Nick initiating small-talk with the group, which he continued to do over the semester. They were all vocal regarding their perceptions that Nick had ignored Lisa and Abby’s task contributions from the start, Lisa repeatedly stating frustration about feeling unheard, while Abby commented: “I just gave up saying anything because he didn’t even listen to me. So, I said nothing.”

Watching video-clips of their final lab elicited further relational dynamics comments, Lisa stating: “I was getting so frustrated this day” because Nick insisted his boat would be the group boat. However, Lisa and Nell then explained “we sort of just gave up and we were like, Nick, you just make the boat” (on behalf of the group), which reflects more closely what actually occurred. They attributed the negative group dynamics to Nick, and ultimately to age difference. While age difference was also present in Group A, it was reported as unproblematic (e.g., the above-mentioned comment of the oldest Group A member praising his peers as “champs” for how they all engaged as a group both on-task and off-task).

The three Group B members repeatedly commented, “we were very chilled, all three of us”; “we’re just really relaxed people...” (referring to the high amount of side-talk). Yet, they also repeatedly mentioned how “angry” Lisa would become during their groupwork, at odds with the “relaxed” comments, and the bickering (e.g., abrupt, curt) between Lisa and Nell that appeared in all five labs.



This went unmentioned in the interview, potentially highlighting a limitation of group interviews, where member/s may not be comfortable expressing fully their real feelings and perceptions of their groupwork experience, although Abby and Nell expressed feeling uncomfortable when Lisa became angry (which was attributed to her frustration with Nick ignoring her task contributions).

In sum, Group A's accounts largely aligned with researchers' observed salience of interpersonal affect dynamics in the interplay of off-task and on-task interactions. Conversely, although Group B's accounts reflected their negative dynamics, their self-reports diverged from researchers' observations (coding frequencies and fine-grained qualitative analysis), which indicated that *all* members had contributed to (cocreated) the group's dynamics.

4. Discussion

The present study focused on the relational realm of groupwork, emphasizing the important function of interpersonal affect as collectively manifest and dynamically cocreated by all members in the social dynamic of groups. The analysis of interactions confirmed self-reports regarding participants perceived negative or positive group dynamics outcomes, showing that interpersonal affect which arose early in off-task and on-task interactions swiftly became interactive patterns, that shaped task participation, and group dynamics outcomes.

This study extends the limited case study research on affect in group interaction as it unfolds in real time, unveiling the microlevel interpersonal affect behaviours that evolve as group patterns, and their function in the collaborative variability that continues to be reported in groupwork (e.g., Lobczowski et al., 2021). The coding scheme was instrumental for capturing the frequency, valence, and temporal evolution of interpersonal affect through behaviours manifest in the natural fluctuation of off-task and on-task interaction for a more complete picture of how social dynamics sequentially unfolded (Langer-Osuna et al., 2020). While group dynamics research has largely relied on static, post hoc self-report methods, this process-oriented study provided a *dynamic* perspective (Vriesema & McCaslin, 2020) that unveiled how in both groups, visible interpersonal affect behaviours comprised a vital piece of the group dynamics puzzle (Barsade & Knight, 2015). Insights afforded through a sociodynamic perspective of affect in the relational realm of groupwork are considered below in terms of key findings, and their implications for groupwork in higher education.

The sociodynamic conceptual lens illuminated the innately interpersonal nature of affect as a jointly manifest and pervasive component of group interaction that was irreducible to any one participant (Mesquita & Boiger, 2014). Its perceptible nature (Bartel & Saavedra, 2000) in the behaviours of participants was traced as dynamically woven through the natural ebb and flow of the groups' on-task and off-task interactions that cocreated each group's social space (Langer-Osuna et al., 2020). The visible nature of interpersonal affect can be viewed through philosopher Sheets-Johnstone's (2009) perspective of affect as fundamentally compelling actors' towards or away from (the group), reflecting the way in which "relational affect" is manifest through *interactions* that are not always emotion expressions (Slaby, 2016). Likewise, social cohesion is broadly defined as "the attraction of members to one another and to the group as a whole" (Forsyth, 2014, p. 136). Importantly, our systematic, microlevel analysis revealed the collective interpersonal affect behaviours that evolved so differently in the two groups, with the opportunity for social cohesion thwarted early in Group B despite some positive efforts (evidenced in the coding results). Alternatively, social cohesion developed early in Group A and was sustained all semester, withstanding inevitable challenges (e.g., during week four, illustrated in Excerpt 4). The finding of early interpersonal affect in shaping both groups' interactive patterns (i.e., negative or positive) over the semester, aligns with previous studies that have identified the influence of early affect in ongoing group processes (e.g., Bakhtiar et al., 2018; Kwon et al., 2014; Näykki et al., 2014), reflecting group development theories regarding the tenuous nature of early group life (Braun et



al., 2020). It highlights the critical role of early interpersonal affect as enacted behavioural phenomena, for the ongoing function of groups.

A key finding was the difference between the two groups of early latent subgroup emergence in Group B while Group A started, and stayed, intact. Fine-grained analysis illuminated how in Group B subgroups developed through seemingly inconsequential behaviours that solidified into increasingly negative interpersonal affect over time. Group dynamics scholars have cautioned the propensity of subgroups for creating tension and conflict (Forsyth, 2014), which the present study not only affirmed but unveiled how they actually emerged. The development of subgroups is underexamined, yet their presence has been observed as unhelpful in higher education groupwork. For example, Näykki et al.'s (2014) case study of group conflict showed participants providing dyadic support for one another, which was not advantageous at group-level, and tensions ultimately diminished the group's task engagement. In the present study, Group B, by their own admission, in the final lab left one member to do the group task alone. Conversely, in Group A, qualitative analysis revealed that rarely, and briefly, were task functions undertaken dyadically, and then always done in different dyads, which appeared a fruitful way of preventing subgroups from inadvertently developing. This is important for students and educators to be aware of since group tasks often involve some activity dispersion. Furthermore, the socially complex dynamic of subgroups, and their consequences also need to be better understood.

The off-task and on-task dyads that were present in Group B not only reduced all-group task participation but also importantly, decreased participants' opportunities for improving their social dynamics, and collaboration skills. In Group B this appeared to create a kind of spiral effect, not only increasing negative interpersonal affect but also further entrenching the subgroups. The detrimental impact of the subgroups echo collaborative learning literature highlighting the importance of working truly together on a task (e.g., Dillenbourg, 1999; Summers & Volet, 2010). Extending the research, which has shown the widespread propensity for students to divide tasks, reducing opportunities for joint engagement (Oțoiu et al. 2019), the present study also revealed the important relational implications this can have, including subgroup development off-task. Especially in first-year university the opportunity to establish subgroup friendships off-task while working within a group may be enticing but as the present study suggests, can be detrimental for group dynamics and task participation. Moreover, the qualitative analysis also showed that side-talk appeared even before tension was evident, signalling its potential in contributing to subgroup emergence also in positive groups, therefore participants need to be aware that seemingly inconsequential side-talk can be counterproductive if frequent and prolonged. Indeed, one Group A member made a significant contribution to side-talk, which was typically responded to only briefly, preventing its establishment as a relational dynamic, and the potential for subgroup development through off-task chat. Alternatively, off-task talk when at whole group-level, enhanced group cohesion (Barkaoui et al., 2008). During their interview, Group A members themselves attributed the social cohesion they had developed as helpful to what they acknowledged as the challenging task of their group science reasoning. In contrast, at their interview Group B participants expressed their aversion to the science reasoning in each lab, which the video-recordings showed at times appeared exacerbated by members not responding to each other's contributions. This may have fuelled perceptions of this aspect of their groupwork as highly negative (rather than challenging) since strong emotion was also expressed about being ignored.

The fine-grained qualitative analysis revealed that another key difference between the two groups was interpersonal attentiveness, with its relative absence in Group B a key source of aggravation. As external observers it was relatively easier to discern attentiveness in Group A's responses to one another when coding interactions. In Group B, systematic lack of acknowledgement of contributions came from all members, exacerbated by nonverbal behaviours such as low eye-contact, making it difficult to distinguish if participants were deliberately ignored or literally unheard. It appeared a combination of both, stemming from the subgroups and in turn further cementing them. Do and Schallert's (2004) study of affect in class discussions found that adult students "tuned out" for numerous reasons, including if discussion was off-track, or to manage negative affect. When side-talk, and non-



responsiveness on-task arose early, Group B participants may at times have mentally tuned out to one another.

In the literature, interpersonal attentiveness has sometimes been observed as *active listening*, categorised as a positive socioemotional behaviour (e.g., García et al., 2020; Isohäätä et al., 2018; Rogat & Linnenbrink-Garcia, 2011). The term interpersonal attentiveness adopted in the present study acknowledges the reciprocal nature of active listening. This is consistent with Scherer's (2005) affect phenomena typology, which includes the *interpersonal stances* actors adopt in social interaction, such as an "active listening attitude" (García et al., 2020, p. 217) displayed through behaviours including eye-gaze, nodding, and verbal responses (Isohäätä et al., 2018). These were apparent in Group A's high frequency of positive interpersonal affect over the semester (e.g., responses of *laughter*, reciprocal *lightening* comments) during task interaction. In Group B, an early tendency towards splitting the group, which evolved into subgroup emergence, increased other negative interpersonal affect behaviours, further reducing group-level interpersonal attentiveness. This led to the frustration and anger expressed in the interview, which although reported as stemming from one participant, the analysis revealed that low attentiveness was visible early from all members (i.e., group-level). Group A did not exhibit, or report being or feeling unheard. The importance of attentiveness for productive collaboration and positive group dynamics outcomes has been shown in various contexts (e.g., Barron, 2003; García et al., 2020; Rogat & Linnenbrink-Garcia, 2011; Ucan & Webb, 2015) and this innately relational (i.e., interpersonal) aspect of groupwork deserves more empirical attention.

5. Limitations, future research, and conclusion

Being an in-depth case study, our sample of participants was necessarily small, but our real-time behavioural data (n=6,500 frequencies) were substantial, capturing a broad range of interpersonal affect behaviours during both off-task and on-task interaction, providing a full picture of group dynamics. Examining the contrast groups in five labs over a semester unveiled the wide range of interpersonal affect behaviours that otherwise would not have been revealed as sociodynamically manifest, their evolution as interactive patterns over time, and their function in task participation and the group dynamics outcomes of each group. The explorative case study design means that while the findings cannot be generalised to other groupwork situations, the contrasting nature of the groups contributes to observational studies that help to explain variability in groupwork outcomes through a detailed exploration of a wide range of interpersonal affect behaviours. Theoretically, the collective cocreation of interpersonal affect in groupwork, manifest through yet underexplored, taken for granted behaviours may be more pervasive, and influential than is currently understood.

Although some participants referred to their prior groupwork experiences in the interviews (three in Group B, and two in Group A) and in video-recordings, the study did not include individual participant data such as prior experience of groupwork. It focused instead on the cocreated, collective nature of interpersonal affect in relational dynamics, given it is now typical in educational contexts and in the workplace, that actors are expected to enter groups with different levels of collaborative experience as well as other individual differences, such as knowledge, attitudes towards groupwork, and goals. However, future research that also includes individual-level background data could provide important insights into how particular individual differences interplay to influence affect, and other group dynamics. Related to this point, how affect functions as interpersonal phenomena in socioculturally diverse groupwork settings is an important research area (Kuppens et al., 2017; Lehmann-Willenbrock et al., 2014) of increasing relevance for education, the workplace, and social life more broadly. Research on university students' intercultural social interaction (e.g., Ujitani & Volet, 2008), for example, has shown that humour expression that is culturally insensitive can result in hurt feelings and misunderstandings.



Individual interviews might also have provided further insight in the present study, as students could be reluctant to fully share their real feelings with their peers. Having one participant absent in each group interview is a limitation indicative of “messy” real-life research. The focus group interviews did, however, provide a window into the way in which each group spoke of an absent member, reflecting the contrasting group dynamics, and the way in which three Group B members had co-constructed their own social meaning of their group dynamics. The study highlights the value of combining self-report and observations for gaining insight into group dynamics (Vriesema & McCaslin, 2020), providing affect data as participants internal feelings and perceptions, and as visibly unfolding sociodynamic phenomena (Barsade, 2002). Importantly, their combined analysis revealed that participants were, variously, more, or less aware of their own behaviours and how they themselves created their group experiences and outcomes, revealing the extent “perceptions and actual behaviours are related to one another” (Lehmann-Willenbrock & Chiu, 2018, p. 1156). Riebe et al. (2016, p. 639) report in their review of higher education teamwork pedagogy that the literature also typically lacks “recognition that students [themselves] have a significant role to play when it comes to the achievement of teamwork learning outcomes.”

Distinguishing off-task from on-task interactions for analytical purposes confirmed Barkaoui et al.’s (2008) finding that all interaction is part of collaboration and therefore should be more widely incorporated into research (Langer-Osuna et al., 2020). The present study also unveiled actual behavioural referents of interpersonal affect as dynamically evolving joint action in groupwork, and perhaps most striking is that even in close proximity face-to-face around their worktable over an entire semester, Group B participants complained of feeling unheard. According to Ferreira (2021), a key issue for collaborative learning is whether participants are actually able to “understand what it takes to participate in joint action” (p. 1466). This may be better understood, Ferreira (2021) proposes, by adopting an embodied perspective that can more deeply incorporate the function of nonverbal phenomena to provide new insights, such as how bodies are utilised in ways that foster or impede collaboration. This could be a fruitful avenue for exploring more deeply the joint nature (Barron, 2003) of interpersonal attentiveness and how it develops as a group norm.

In this study, we explored interpersonal affect in the relational realm of group interaction in a comparative case study with two small groups of students in the same class, who reported contrasting group dynamics outcomes (negative and dysfunctional; positive and collaborative). Systematic coding traced the sequential flow of interpersonal affect in groups’ social interaction as it naturally ebbed and flowed through task focused (on-task) and more informal (off-task) interactions, revealing specific behaviours which arose during early group interaction that were formative for the different relational pathways that each group took over time. The study unveiled seemingly routine, everyday interpersonal affect behaviours (e.g., side-talk; humour; laughter) on a micro time-scale which, taken together, unfolded over the semester as interactive patterns, and group dynamics outcomes.

Keypoints

- Exploring the interplay of off-task and on-task interactions enabled unique insights into interpersonal affect in groupwork.
- Interpersonal affect emergent in groups’ first meetings, served as affective inputs to subsequent meetings.
- Interpersonal affect behaviours evolved over time into macro-temporal interactive patterns and group process outcomes.
- Combining observations and self-report data revealed variance in participants’ awareness of their own behaviours in co-creating their group dynamics.
- The study revealed that subgroups can emerge during off-task or on-task interaction, proving detrimental to group cohesion.



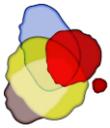
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Appendix A

Group task and activities in five labs

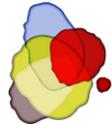
	Learning task	Activities
Week 2	<i>The nature of science; thinking scientifically</i> Designing a simple investigation: observing; communicating; classifying; measuring; predicting; comparing; formulating hypotheses; the importance of observations & inferences.	Prepare Oobleck & Psylli slime per the lab manual instructions. Discuss & record observations of characteristics of each product. Discuss ideas about Oobleck (relate to scientific principles of liquids and solids). Shared reasoning: Discuss & write a scientific principles reasoning statement.
Week 3	<i>Classification of matter & physical, chemical changes</i> (“powders lab”): Investigating; observing; recording observations; designing data table/s; identifying chemical substances by their unique properties.	Identify the powders (four uncategorised household powders): Observe, discuss each powder’s appearance (lab manual instructions & question guide). Conduct series of tests on each powder: with water; vinegar; heat. Discuss & record observations; agree identifying characteristics of powders. Discuss & write group predictions of what each powder is based on test results.
Week 4	<i>Chemical reactions & fair tests</i> (“rocket lab”): Plan, conduct, & prepare results of open-ended investigation involving a chemical reaction. Identify independent, dependent, & control variables.	Test for best “rocket”: Plan experiment; formulate research question; hypothesis; procedure for conducting investigation; record & analyse results data; draw conclusions; evaluate procedures. <i>[After experimentation outdoors]</i> : Discuss & agree general science principles involved in the fair test investigation. Write group reasoning statement: what occurred and why, using scientific principles.
Week 7	<i>What is energy?</i> (“squishy circuits lab”) Exploring energy forms: electrical properties & how to make electrical circuits.	Make series, and parallel electrical circuits using salty and sugary playdough; battery, wires, & LEDs. Discuss what happened & why based on science principles (i.e., conductivity of salty playdough; insulating properties of sugary dough; different electrical pathways of series & parallel circuits.) Write group scientific reasoning statement using science principles.
Week 12	<i>Working with forces. Why do some things float?</i> (“boat competition lab”) Plate tectonics; density; surface tension; buoyancy.	Predict & test the buoyancy of various size/density objects in water. Make individual foil “boats” to float with the most “cargo” (marbles). Based on best individual boat in group, design group boat for intergroup (class) “boat competition”. Discuss winning boat using scientific principles for group reasoning statement.



Appendix B

Coding scheme for individual-level interpersonal affect behaviours in groupwork

Off-task positive	Off-task negative	On-task positive	On-task negative	Non-affective
<p>Small talk is social chat, like asking how other/s feel, generic topics (e.g., weather). Talk of personal interests signifying relational effort (e.g., cooking; sports; study; movies; games), getting to know member/s. This may include acknowledging small talk (e.g., “yes”; “sounds interesting”). And/ or displaying reciprocal interest (e.g., “and you?”). Small talk is generic enough to be inclusive of all members (i.e., not exclusive talk about someone/ something known only to some members (coded <i>side-talk</i>).</p> <p>Humour and joking that is not task related but instead is socially-focused. Humour, joking that is positive, (i.e., not sarcastic or with malicious intent to put other/s down or be derogatory) but rather appears intended as sharing fun or enjoyment, light-hearted.</p> <p>Laughter member/s laughing (e.g., response to humour), a clear [nonverbal] behaviour that is part of relational small talk.</p>	<p>Small talk Negative Off-task talk negative in tone (i.e., critical about study or about other/s, gossiping, complaining. May include negative utterances about the context generally (i.e., that something is annoying). Talk that has generally a negative tone and may contribute to diminishing a group’s positive atmosphere; does not foster positive mood.</p> <p>Side-talk socially focused talk in the form of side chat (i.e., may be indicated by low volume/ whispering, thus excludes other/s who cannot hear) or subject matter excludes other/s. [<i>Side-talk</i> “splits” the group focus. May potentially be perceived by other/s as ‘social loafing’ if some not task-focused while others are].</p> <p>Using mobile phone member using phone (i.e., texting, scrolling, viewing screen, for personal use, not for the group task. [Code when behaviour commences, for duration/until phone is put down/away].</p>	<p>Inclusiveness Encouraging, addressing quiet participants; using names; check all agree, understand; invite ideas. [Using “we”, “our” at key phases].</p> <p>Offering praise or support Positive remarks about other/s contribution beyond just agreeing, e.g., “good thinking”; “well done”; “I see what you mean”. May take the form of extending, building on other/s contribution.</p> <p>Showing enthusiasm, interest explicitly expressed enthusiasm, keen interest in task, evident not only in talk but its delivery (i.e., tone, pitch, speed, volume.)</p> <p>Lightening the atmosphere such as with humour, in some way task-related (e.g., “word-play”) but not totally “off-task” (which would be coded <i>humour and joking</i>). Could also be lightening tense situations.</p> <p>Laughter [task-related], positive, in response to, initiating, or <i>lightening the atmosphere</i> (non-derisive, non-sarcastic).</p>	<p>Complaining; negative utterances about aspect/s of task, topic. It may include sarcasm, or expressing the task as unimportant, undermining task.</p> <p>Criticizing/running someone down Disparaging comments about others, or their contributions.</p> <p>Abrupt, curt, or rude behaviour; Interrupting to over-rule; Ignoring Speaking curtly, rudely, or abruptly (i.e., highly directive). Or, evident a suggestion/ question is deliberately ignored. Cutting someone off while speaking with intent to over-rule. [<i>But, not when member/s speak at once accidentally in participating</i>].</p> <p>Disrupting task flow with low-level talk that may have effect (or intent) of disrupting task focus; it may trigger off-task talk; or interrupt or diminish/ reduce (negatively impact) flow, quality of task talk.</p> <p>Splitting group Suggesting/ initiating/referring to split group (without justification like running out of time to finish).</p>	<p>Task interaction NA Task-related talk with no overtly visible affect indicators. Talk related to member/s engaged in task procedurally (i.e., reading aloud instructions; dictating answers; talk about materials; planning/ organizing); or “hands-on” activity; or higher-level science content talk (e.g., conceptual, explaining).</p> <p>Empty talk is very low-level talk, can be off-task or task-related but <i>not</i> efforts towards task (e.g., “I can’t find my pen”).</p> <p><i>Empty talk</i> differs from <i>small talk</i>: Small talk may have a relational purpose (e.g., being “friendly”, civil, social chat (i.e., study, sports, movies, cuisine, weather), but <i>empty talk</i> may have no particular target/ purpose. It does not contribute to the group task but does not appear aimed to deliberately disrupt task flow.</p>



Appendix C

Coding scheme for individual-level interpersonal affect behaviours in groupwork with data examples

Behavioural category and code	Example
Off-task positive	
<i>Small talk</i>	<i>"How does everyone else feel? Good?"; "Do you have a cold?"; "No I've got allergies"; "Running late, were you?"; "Yeah, I missed the train"</i>
<i>Humour and joking</i>	<i>"It's like a Star Wars punishment?"; "You're gonna be a quality Dad, you've already got your Dad jokes ready!"</i>
<i>Laughter</i>	<i>Laughter that is related to the social chat</i>
Off-task negative	
<i>Small talk Negative</i>	<i>"I'm just tired. I'm sick. We're all sick"; "Yeah, don't become teachers you'll be sick"; "I swear it's getting worse as the day goes on"</i>
<i>Side-talk</i>	<i>"We'll have to ask [name] how his surgery went..."; "He seems like a nice guy" [looking at other/s phone]</i>
<i>Using mobile phone</i>	<i>Using phone for personal purposes: scrolling; texting; talking on phone</i>
On-task positive	
<i>Inclusiveness</i>	<i>"Now, [name], you can do the honours it you want"; "I think we've got this! All over it!"; "Everyone else agree with that?"</i>
<i>Offering praise or support</i>	<i>"Ooh, look at his prep skills, it's immaculate!"; "That's so good [name]!"; "Do you want help?"; "Oh yeah, good point!"</i>
<i>Showing enthusiasm, interest</i>	<i>"I'm still blasting rockets in the air, it's still cool!"; "This should be interesting. Listen, listen! It's sizzling!" "That's awesome! I wonder why it's flashing like that..."</i>
<i>Lightening the atmosphere</i>	<i>"The hot air from my mouth could keep it up in the air!"; "Yeah, we just don't have the power Captain" "Oh, she might have madness to her reasoning"</i>
<i>Laughter</i>	<i>Laughter that is related to the task focus</i>
On-task negative	
<i>Complaining; negative expressions</i>	<i>"I'm bored"; "I can't be bothered!"; "I'm starting to hate this experiment"</i>
<i>Criticising/running someone down</i>	<i>"...your handwriting's driving me insane"; "No, it does! She's wrong!"; "We spend half an hour organising what we're gonna do"</i>
<i>Abrupt, curt or rude behaviour; Interrupting to over-rule; Ignoring</i>	<i>"Shut up!"; "Noooo, hang on!"; "You're reading the wrong one!" "Oh no. It's a circuit love. Not just to play...there's a certain way to connect things!"</i>
<i>Disrupting</i>	<i>"You calm down!" [said jokingly to member reading aloud conceptual question, stopping task discussion from proceeding]; "Are you going to your class today?" [Spoken as member is science explaining, disrupting conceptual reasoning]</i>



Splitting group

"Well do we want to split in two's? Two make the Oobleck and two make the psylli slime?"; "We'll continue doing this if you guys want to do that"

Non-affective

Task interaction [Non-Affective]

"What did you write?"; "Okay put green in the middle there and then we create the series circuit"; "It doesn't do anything. It's an insulator. It doesn't conduct"

Empty talk

"What was I gonna say?"; "Okay I need to write my name..."



Appendix D

Breakdown of interpersonal affect behavioural codes by frequency (and %) over time in five labs

	Week 2	Week 3	Week 4	Week 7	Week 12	Week 2	Week 3	Week 4	Week 7	Week 12
Category and code	Group A					Group B				
Positive off-task:	209 (32.7)	165 (19.6)	78 (18.0)	314 (38.3)	258 (27.5)	69 (14.9)	24 (3.5)	38 (8.06)	75 (12.2)	18 (3.0)
Small talk	158 (24.7)	101 (12.0)	41 (9.4)	236 (28.8)	167 (17.8)	56 (12.1)	19 (2.8)	35 (7.4)	69 (11.2)	17 (2.9)
Humour	27 (4.2)	43 (5.1)	20 (4.6)	44 (5.4)	49 (5.2)	7 (1.5)	4 (0.6)	1 (0.2)	4 (0.7)	0
Laughing	24 (3.8)	21 (2.5)	17 (4.0)	34 (4.1)	42 (4.5)	6 (1.3)	1 (0.1)	2 (0.4)	2 (0.3)	1 (0.1)
Negative off-task:	14 (2.2)	24 (2.9)	4 (0.9)	26 (3.2)	32 (3.4)	21 (4.5)	49 (7.1)	49 (10.4)	148 (24.1)	137 (23.0)
Neg s/talk	2 (0.3)	3 (0.4)	1 (0.2)	5 (0.6)	0	5 (1.1)	3 (0.4)	5 (1.1)	23 (3.7)	9 (1.5)
Side talk	5 (0.8)	19 (2.3)	2 (0.5)	10 (1.2)	27 (2.9)	15 (3.2)	45 (6.6)	39 (8.3)	110 (18.0)	106 (17.8)
On phone	7 (1.1)	2 (0.2)	1 (0.2)	11 (1.4)	5 (0.5)	1 (0.2)	1 (0.1)	5 (1.0)	15 (2.4)	22 (3.7)
Positive on-task:	137 (21.4)	185 (22.0)	87 (20.1)	122 (14.9)	193 (20.6)	55 (12.0)	72 (10.5)	45 (9.55)	60 (9.8)	78 (13.1)
Inclusive	16 (2.5)	15 (1.8)	12 (2.8)	15 (1.8)	15 (1.6)	10 (2.2)	7 (1.0)	6 (1.3)	8 (1.3)	6 (1.0)
Praise/support	19 (3.0)	16 (1.9)	10 (2.3)	3 (0.4)	39 (4.2)	9 (2.0)	13 (1.9)	11 (2.3)	14 (2.3)	13 (2.2)
Enthusiasm/interest	9 (1.4)	15 (1.8)	1 (0.2)	26 (3.2)	21 (2.2)	4 (0.9)	8 (1.1)	3 (0.6)	20 (3.2)	13 (2.2)
Lighten atmosphere	53 (8.3)	71 (8.4)	32 (7.4)	45 (5.5)	66 (7.0)	16 (3.45)	27 (4.0)	18 (3.8)	14 (2.3)	32 (5.4)
Laughter	40 (6.2)	68 (8.1)	32 (7.4)	33 (4.0)	52 (5.6)	16 (3.45)	17 (2.5)	7 (1.5)	4 (0.7)	14 (2.3)
Negative on-task:	8 (1.3)	6 (0.7)	5 (1.1)	23 (2.8)	31 (3.3)	29 (6.2)	43 (6.3)	34 (7.2)	41 (6.7)	49 (8.2)
Complaining/neg talk	6 (1.0)	1 (0.1)	3 (0.7)	10 (1.2)	3 (0.3)	4 (0.9)	10 (1.5)	8 (1.7)	18 (3.0)	10 (1.7)
Criticise/ run down	0	1 (0.1)	1 (0.2)	1 (0.1)	1 (0.1)	3 (0.6)	9 (1.3)	4 (0.85)	5 (0.8)	7 (1.2)
Abrupt/ curt/ ignore	0	1 (0.1)	1 (0.2)	4 (0.5)	8 (0.9)	12 (2.6)	20 (2.9)	18 (3.8)	12 (2.0)	25 (4.2)
Disruptor	2 (0.3)	3 (0.4)	0	8 (1.0)	19 (2.0)	0	0	0	5 (0.8)	5 (0.8)
Splitting group	0	0	0	0	0	10 (2.1)	4 (0.6)	4 (0.85)	1 (0.1)	2 (0.3)
(On) task non-affect	258 (40.4)	450 (53.6)	252 (58.1)	312 (38.0)	415 (44.2)	279 (60.1)	490 (71.6)	302 (64.1)	274 (44.6)	310 (52.1)
Empty talk	13 (2.0)	10 (1.2)	8 (1.8)	23 (2.8)	10 (1.0)	11 (2.3)	6 (1.0)	3 (0.6)	16 (2.6)	3 (0.5)
Total	639 (100.0)	840 (100.0)	434 (100.0)	820 (100.0)	939 (100.0)	464 (100.0)	684 (100.0)	471	614 (100.0)	595 (100.0)