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A STUDENT TEAMWORK INDUCTION PROTOCOL

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Abstract

Faulty group processes have harmful effects on performance but there is little research about intervention protocols to pre-empt them in higher education. This naturalistic experiment compared a control cohort with an inducted cohort. The inducted cohort attended a workshop, consultations, elected a leader and used tools (a group log and group contract) designed to minimize social loafing, optimize coordination (by boosting good information sampling) and orient group dynamics towards the task. In the absence of inductions, a faulty system of processes was in play and this had a significant impact on group performance. In contrast, the inductions created a buffer. Structural equation modeling showed that the intervention made both group cohesion and conflict beneficial to group performance. The induction protocols enhanced students' individual accountability, a sense of unique responsibility and dissent during group decision-making (which improved its quality). The implication is that inductions help optimize the processes within student teamwork.

Key words: Assessment; Coordination; Educational innovation; Engagement; Group work; Group support; Induction; Productivity; Individualism.

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1. Introduction

The actual performance of a group generally falls short of its potential performance because of faulty processes (Steiner, 1972). Group work in educational settings is widespread and group assessments often contribute to final course/degree results (Hoffman & Rogelberg, 2003). Despite this, a lot of research shows that faulty group processes affect students' performance. The deficit between actual and potential performance comes from losses in the process of doing group work (Steiner, 1972). The process losses can be classified into four categories: (1) motivation losses; (2) coordination losses; (3) harmful group dynamics; and (4) problematic individual differences. As an example of motivation losses, Price, Harrison and Gavin (2006) found evidence of 'social loafing' – the tendency to feel less motivated about maximizing one's effort when working in a group – among students doing group tasks. Jung and Sosik (1999) likewise found low preferences for group work among students. In terms of coordination losses, evidence shows that student group performance is affected by poor structuring of the task (Gillies, 2003) and by coordination problems (Kamau, 2010). This echoes evidence from other groups. Sub-optimal coordination in groups is a common problem (Janicik & Bartel, 2003) and involves poor synchronization between group members (Rogelberg, Barnes-Farrell & Lowe, 1992), a leadership style that is inappropriate for the task (Peterson, 1997) or poor sharing of pertinent information (Winqvist & Larsson, 1998). A third source of group productivity losses is problematic group dynamics; examples are counterproductive norms or *modus operandi* as far as decision-making is concerned (Postmes, Spears & Cihangir, 2001) and a sense of being 'trapped' into continuing down the path of a faulty decision (Kameda & Sugimori, 1993). Certain individual differences within the group can likewise be problematic in creating group productivity losses. Evidence shows that different group members have different desires for power (Fodor & Smith, 1982), conform to norms to a different extent (Hogg, Abrams, Otten & Hinkle, 2004), vary in having a task-focused or relationship-focused style when interacting with others (Fiedler, 1971) and people also differ in the extent to which think of themselves and others from an individualist or collectivist point of view (Gudykunst & Lee, 2003). The challenge is therefore to find a way of preventing these potential sources of group process losses from harming student group productivity.

1.1. Faulty processes in groups

1.1.1. Motivation problems

A shortfall in motivation during group work produces social loafing, which involves a group member deliberately expending less effort than they are capable of (Latane, Williams & Harkins, 1979; Karau and Williams, 1993). A student group member who is loafing displays avoidant behavior such as skipping group meetings, participating little in group discussions and not completing tasks (or not completing them in time). This happens because there is a 'dilution' of the impact of the instructions given to group members (social impact theory, Latane et al., 1979): the responsibility for the fate of the group feels like it will be distributed and is therefore not so worrisome. Motivation losses are likely to be greatest in a group assignment which will not be marked or have consequences for the students' grades. Even if it will be marked, it is can be difficult to identify or evaluate different students' contributions as individuals (Nordberg, 2008) and so many group assessments receive a joint mark. The lack of individual accountability increases social loafing, as evidence from Harkins and Jackson (1985) and a meta-analysis by Karau and Williams (1993) shows. An ideal student group will therefore sub-divide and log tasks in such a way that each student is responsible for a unique set of outcomes.

Another source of motivation problems is that, if a group is left to its natural devices, there can be actual or perceived inequity in the effort that each group member is spending on the task. An effective prevention against social loafing is therefore ensuring that there is equity among group members (Jackson & Harkins, 1985). It is also useful to raise group members' expectations about each other (Jung & Sosik, 1999). Equity is important because a student who believes that someone else in the group is doing less work can reduce their own effort; they will display avoidant behavior and reduce their engagement with the group in the hope of equalizing the effort costs. Therefore, an ideal group scenario involves transparency among students about exactly who is doing what, frequent accounts between students about what they are working on, as well as a formal contract about the amount of effort expected from each member. Evidence shows that intervening against social loafing can actually encourage what is called social laboring, which is when group members invest more

effort toward a group task than the amount of effort they would invest if it was an individual task (see a review of social laboring/facilitation by Aiello & Douthitt, 2001).

1.1.2. Coordination problems

Weak coordination of a group is more than simply a problem with a group's leadership. Group coordination tends to be poor in the sense that there is often weak synchronization between group members in their efforts toward the task (Rogelberg, Barnes-Farrell & Lowe, 1992). One example of poor synchronization is a group carrying out a literature review before creating a strategic list of keywords that would help them minimize the duplication of effort or missed results. Evidence also shows that the performance of students who are working in a group is affected by poor structuring of the task (Gillies, 2003). An ideal group will therefore have clear roles for each student detailed within a group contract, a sequential log of when each sub-section of the task was completed and a scheduled meeting to discuss synthesis.

Poor sharing of information pertinent to the task (Winquist & Larsson, 1998) is also a common coordination problem. Evidence shows that students' performance in group tasks is affected by group meetings which are too few or too short in duration (Kamau, 2010). Students working in a group should schedule and log regular meetings because meetings are useful in allowing the sharing of information which helps in strategizing the group's approach. Imagine a group of students whose task is to interview workers at a manufacturing plant for a joint research project. On the day of the research interviews, they find out that only one student was aware of a crucial detail (e.g., the time needed to complete health and safety checks) which affects the interview schedule planned by another student and means they cannot now complete all the interviews they planned. Many coordination losses therefore arise from the ways in which groups tend to deal with information (Winquist & Larsson, 1998). Groups exhibit a bias for information already shared by all members (Greitemeyer, Schulz-Hardt, Brodbeck & Frey, 2006); for example, students in a group meeting are likely to talk about commonly held documents such as the course textbook more than documents sourced by individuals while working on the group task, such as journal articles sourced from a database. Groups also exhibit a bias for information that is concordant with the group's existing views (Stasser & Titus, 1985); a group which decided to introduce their oral presentation with X set of bullet points

summarizing certain theoretical arguments is unlikely to backtrack on this even if, in hindsight, a different sort of introduction would be more effective. Additionally, group decisions tend to be swayed by novel information (Vinokur, Burnstein, Sechrest & Wortman, 1985); a group of students studying biology are likely to relay a theory from accounting with less critical evaluation than if they were citing a theory from biology, and vice versa for students in accounting. An ideal group will treat information from unfamiliar topics with as much critical evaluation as information from familiar topics.

Effective remedies for the phenomenon of poor information sharing include training groups about decision-making (Larson, Foster-Fishman & Keyes, 1994). In an ideal group scenario, the students have a clear plan (written into their group contract) about how to share information; this can be done through an online platform which allows uploads and live updates. As well, they will have a plan about how to challenge the group's existing views about which information is vital or useful to the assignment; this can be done by having a section of each meeting which works as a 'suppose the opposite...' brainstorming session. The ideal group will have a member or members systematically introduce or contrive dissent against the group's views (the dialectical technique, Greitemeyer et al., 2006). An ideal student group meeting could also appoint at least one designated 'dissident' who points out the disadvantages of the group's plans during the discussion. Evidence shows that another effective method of optimizing information sharing is structuring group discussions by creating sub-groups comprising two members who gather information separately; each sub-group then relays the information to the whole group in turn (Rogelberg et al., 1992). In an ideal group scenario of six students working towards an assessment due in several weeks' time, the whole group will meet once a week but, on other days, each pair will work independently and share information with other members via e-mail or an online platform.

Another type of weak coordination stems from a leadership style which is inappropriate for the task (Peterson, 1997). We can make deductions about which leadership style is appropriate by evaluating the demands of the task, the quality of the relations between the leader and the group members, and also by considering the leader's level of power (Fiedler's 1971 contingency theory of leadership, see Peters, Hartke & Pohlmann, 1985, for a meta-analysis of the theory). Leadership style can be characterized using Lippitt and White's (1943) typology of the democratic style, which is relationship- and consensus oriented, versus an autocratic style, which is task-oriented and geared towards implementing the leader's decisions. It has been reported that a democratic leadership style

leads to better outcomes than an autocratic leadership style, such as better group performance (Brown, 2000), stronger group identity (Dion, 2000), more friendliness among group members (Lippitt & White) and better sharing of factual information (Foder & Smith 1982). However, more recently, these types of leadership have been characterized as facilitative versus directive leadership styles (Peterson 1997) and there has been the recognition that, in some circumstances, an autocratic leadership style *can* produce better group outcomes (see Aldag & Fuller, 1993, for a review of early studies). This is if the 'directiveness' is about the process of working as a group, rather than the outcomes of group activities. Peterson (1997) found that process directiveness correlated negatively with defective decision-making, in a re-analysis of decision episodes first analyzed by Tetlock, Peterson, McGuire, Change & Feld (1992), e.g. Pearl Harbor, Chamberlain, Bay of Pigs, the Marshall plan, and others. Peterson also found that process directiveness predicted stable group outcomes and few productivity deficits, in an analysis of decision episodes from San Francisco city councils, whereby the outcomes/deficits were financial. In fact, it is process directiveness that can be said to connote good coordination. For instance, Janicik and Bartel (2003) define effective coordination as dividing tasks among members, "temporal planning" (p. 126; scheduling tasks, planning meetings, prioritizing tasks, etc.), and setting targets. An ideal student group leader is thus careful to ensure that the group's information sharing procedures are optimal and that procedural aspects of coordination happen (e.g., scheduling frequent meetings, keeping a group log, and ensuring task-fruitful meetings).

1.1.3. Harmful group dynamics

Group dynamics concern the quality of relationships among group members. Excellent magnetism between people in one group is not necessarily a recipe for good group performance. Such magnetism is conceptualized as high group cohesion (Hogg & Hains, 1998) and it can mean that people in the group prioritize maintaining harmony and a sense of shared identity over making optimum decisions (which can require disagreement). Student groups with high group cohesion have been found to perform worse when there is the threat of being evaluated (Turner, Pratkanis, Probasco & Leve, 1992), suggesting that friendship-based student groups are risky in an assessment context. Other problematic group dynamics include the group's norms or *modus operandi* as far as decision-making is concerned (Postmes et al., 2001). A group with the norm that discussions must always

reach a consensus and that members should mostly agree with each other can be problematic: the group's initial unanimity about a decision can create a sense of 'group entrapment' further on, making the group members feel compelled to continue along the path of the same decision despite reasons for an alternative (Kameda & Sugimori, 1993). Therefore, to prevent the problematic group dynamics which are associated with high group cohesion, an ideal group assessment scenario should most probably involve students who are unfamiliar with each other or only acquainted as study peers.

It is possible for group cohesion to be good – if it involves prioritizing the task and the group's performance. Some authors argue that there are two types of group cohesion. High 'task-oriented cohesion' is beneficial because it involves prioritizing the quality of the group's performance; in contrast, high 'relationship-oriented cohesion,' which involves group magnetism, attraction and prioritizing group harmony, is detrimental to group decision-making and other aspects of performance (see Dion 2000 for a review). A task-orientated style has been shown to be least present in groups suffering from groupthink (see, for example, Tetlock et al., 1992, who analyzed decision episodes from the Chamberlain, Carter, Ford and Kennedy governments). Groupthink symptoms have likewise been shown to be least prevalent in task-oriented groups (Berntal & Insko 1993). An ideal student group is therefore one which comprises students who are primarily concerned with optimizing the process of completing the group assessment. If a group comprises students who happen to be good friends with each other outside class, the students should agree to adopt a task-orientated approach when they are working on the assessment. Formalizing this agreement through a written group contract could help.

1.1.4. Problematic individual differences

Personality traits and attitudes matter because some group-relevant psychological variables exist in greater quantity in some individuals, compared to others. For example, group members differ in the extent to which they emulate or deviate from prototypical group norms (Hogg et al., 2004). As well, group members differ in the extent to which their 'self-construal' is individualist or collectivist (Gudykunst & Lee, 2003), even within one cultural environment (Oyserman & Lee, 2008). Self-construal is the way that a person sees him or herself in relation to others. High individualist self-construal involves placing a lot of importance on being unique, competing against other individuals,

and feeling that individual accomplishments are more important than group accomplishments. High collectivist self-construal involves placing a lot of importance on being in a group, prioritizing group goals and placing high importance on group accomplishments. These forms of self-construal can determine a student's approach to a task that was assigned to a group, relative to a task assigned to them as an individual. There is the assumption that some societies are mainly individualistic whereas others are mainly collectivistic (Hofstede, 1980) but this generalization has been contested. It has, instead, been shown that individualism and collectivism are individual-difference constructs which co-exist within each society (Heine, Lehman, Peng & Greenholtz, 2002), which co-exist within each individual (Eby & Dobbins, 1997), which are independent/orthogonal to each other not opposites (Jackson, Colquitt, Wesson & Zapata-Phelan, 2006), which can be primed by situational factors (Oyserman and Lee, 2008), and which can be experimentally enforced as group norms (Hornsey, Jetten, McAuliffe & Hogg, 2006). The important differences in levels of individualism or collectivism are therefore those differences *within* each cultural setting, rather than between settings (Heine et al., 2002). This offers the prospect for a student group assessment context to activate collectivist self-construal irrespective of the surrounding cultural norms. Additionally, an ideal group assessment can harness individualist self-construal for the good of the group's performance by ensuring that each individual has unique responsibilities and feels hopeful of the chance of recognition for their individual strengths.

1.2. Interventions against faulty processes

There is sparse research implementing and testing interventions against all these faulty group processes in the context of students working on a group assessment. One study, by Brigman and Webb (2007), tested an intervention called 'Student Success Skills' to help high school students learn about effective group work practices. Brigman and Webb's (2007) intervention took a counseling approach by focusing on the students' cognitive, interpersonal, social and self-management skills. Such a counseling approach is important but a group process approach would also be beneficial, considering the bulk of research showing how group processes can explain sub-optimal group productivity. Existing research about the impact of group processes on student group task performance is sparse. Kamau's (2010) study involved the implementation of group logs by students

doing assessed group work. The group logs were designed to measure coordination and Kamau showed that this had an impact on the performance of the students in their group task. However, this intervention did not address other sources of group productivity deficits. We need inductions pre-empting not just coordination losses but also motivation losses, losses due to group dynamics and losses created by individual differences. Diamond's (1972) study involved the implementation of a leader in each group of students doing group work. As well, Diamond offered the students consultation sessions that gave them advice about structuring their groups. However, Diamond's study tells us about the impact of these interventions on the students' satisfaction, but not on their performance relative to the performance of other cohorts doing group work. We needed a study which does this.

1.2.1. An experiment into induction protocols

First, interventions were implemented from the start of the term, in one cohort of students doing group work that would be graded (a parliamentary-style debate presentation). The interventions can be summarized as follows: each group kept a group log, created a group contract, chose a group captain, attended a workshop on group productivity, had the offer of a consultation session and attended a taught session on the psychology of group productivity. Additionally, each group was encouraged to choose a name, to set up an online platform for communication (e.g. a forum on the university's virtual learning environment, or a group on the networking website Facebook), and in the event of conflict they had the option of requesting mediation by the tutor. The creation and use of a group contract has been shown to be an effective way of optimizing the group process (Hare & O'Neill, 2000), and group logs have been shown to be effective group process monitoring tools (Valine, 1983; Kamau, 2010). The other interventions were implemented on the basis of the theory- and evidence-based rationale outlined thus far.

Secondly, and quite independently from the course described above, a research assistant invited all students doing group work in the department to take part in some research in exchange for participation time credits. This yielded a sample of students from the intervention cohort, and also from other cohorts (the control sample). The study measured group climate, group cohesion, individualist self-construal, collectivist self-construal and task orientation, and (after the summer exam

board) recorded the performance of each participating student's group – the grade awarded for the group work. The effects of the aforementioned variables on group performance were explored through regression models to answer two questions: (i) Did the intervention prevent faulty processes from having an impact on group performance? (ii) Was the intervention effective even after taking into account self construal as a source of individual differences? Structural equation models were then tested to explore the overall picture, to answer the third question: (iii) In the overall model predicting student group performance, what did the presence/absence of the intervention do?

2. Method

2.1. Participants

Participants responded to advertisement posters, e-mails and campus online posts to students in the university psychology department. The adverts invited any student doing group work to take part in some research in exchange for research participation time credits. There were 120 participants that took part. Of these, 38 were excluded from further analysis because they were not doing group work that was going to be graded, or because they were not going to receive a joint mark for their group work. This left 82 participants, all of whom were in the process of completing a group assessment for a joint group grade, 35 of whom were from the intervention cohort and 47 from the control sample. The group work involved in both cohorts was comparable: all were presentation-based assessments; the preparation involved searching literature, developing ideas, having group meetings outside of class time, and so on. The sample of 35 participants from the intervention cohort represented a large proportion of the entire intervention cohort that year – 64%. The entire sample of 82 participants had a mean of 4.11 members in their group ($SD = .85$) and thence far a mean of 5.1 meetings ($SD = 7.49$) with their group, averaging 52.33 minutes per meeting ($SD = 39.44$). There were 64 females and 18 males. The 82 participants consisted of 27 first year, 17 second year and 38 third year undergraduates.

2.2. Measures

The materials comprised consent forms, questionnaire packs, debrief sheets and exam board results. The questionnaire pack began with the instructions:

“In the following questions, please respond in terms of your current group-work. If you are doing more than one unit with group-work, please respond to the questions with only one of the units in mind..:”

The term ‘unit’ refers to a module or (in the US context) a course. The instruction was followed by devised items asking general questions about the group assessment (e.g. the name of the course and the name of the assignment); this information was later used to locate the mark obtained for the group assessment from exam board results. There were also questions about the number of members in each group, number/duration of meetings, whether there was a leader, if the group had a name, if group members had ever worked together before, if they had chosen the group or else been allocated to it by a tutor and so on.

In counter-balanced order, the questionnaire pack consisted of: (i) the Least Preferred Co-worker Scale (LPC scale, Fiedler & Chemers 1984), with a Cronbach’s internal reliability alpha value of $\alpha = .94$; the LPC scale measures the task- or relationship-orientation of a participant when working in a group, by asking him/her to rate on 18 dimensions and using a 1-8 response scale someone that he/she found the most difficult to work with, e.g. tense-relaxed, boring-interesting, disagreeable-agreeable. (ii) The 25-item Group Cohesion Scale (Treadwell, Laverture, Kumar & Veeraraghavan, 2001), Cronbach’s $\alpha = .66$, with items such as “Group members usually feel free to share information”, “Most group members contribute to decision making in this group”, “Group members usually feel free to share their opinions”, “Group members influence one another”, “There is a feeling of unity and togetherness among group members”. This scale has been used on samples of students doing group work, is reported to be a good way of ‘diagnosing’ group cohesion in applied settings (Treadwell et al., 2001) and has been used in group psychotherapy settings (Taube-Schiff, Suvak & Antony, 2007). Additionally, the items in this scale tap into task-oriented group cohesion, with most of the items denoting behaviors that are known to prevent groupthink or are the opposite of known symptoms of groupthink. (iii) The 28-item How Do I See Myself scale (Gudykunst & Lee, 2003), Cronbach’s $\alpha = .92$, which measures individualist self-construal (e.g. “I consult with others before making important

decisions”, “I try not to depend on others”) and collectivist self-construal (e.g. “I am a unique person separate from others,” to be reverse-coded; “I will stay in a group if they need me, even when I am not happy with the group”). (iv) The 12-item Group Climate Questionnaire (MacKenzie, 1983) consisting of 3 sub-factors: group conflict (4 items, e.g. “There was friction and anger between the members”; “The members rejected and distrusted each other”), Cronbach’s $\alpha = .88$; engaging behavior (5 items, e.g. “The members revealed sensitive personal information or feelings”), Cronbach’s $\alpha = .56$, and avoidance behavior (3 items, e.g. “The members were distant and withdrawn from each other”), Cronbach’s $\alpha = .06$ (only having 3-items). The Group Climate Questionnaire has been widely used, such as in group psychotherapy settings (e.g. Kivlighan & Lilly, 1997; Ogrodniczuk & Piper, 2003) and is recognized as a measure of the individual’s experience of his/her group (Bakali, Wilberg, Hagtvet & Lorentzen, 2010). At the end of the questionnaire pack was a section asking the participant for his/her signed consent for the researchers to access and record the mark that his/her group obtained for the assessment at the end of the academic year when exam board results were released.

2.3. Procedure

The interventions described in the introduction were delivered by the lead researcher, whereas data were collected by a research assistant who was not involved in the delivery of the interventions or with assessment of the students’ work. Grading of the intervention students’ group work was done independently from the study, with independent grading of the debate content by two tutors contributing 75% of the mark (one being the lead researcher, the other being a tutor unconnected with the study) and grading by the audience viewing the debate contributing 25% of the mark (these were students in the cohort not debating that day). The procedure for the study involved asking participants who volunteered to read and sign a consent form to complete a questionnaire pack, and thereafter they were given a debrief sheet. When final assessment results were available at the end of the academic year, the performance of the participant’s group was recorded.

3. Results

Each student's responses to the questionnaires were entered into PASW software and items which needed recoding (based on the scale instructions) were reverse-coded. Each component of the questionnaire was then subjected to reliability analysis (see Cronbach's alpha reliability values reported within the method-materials). A mean score was then calculated for each student, for each component of the questionnaire.

3.1. Comparisons of correlation patterns (intervention vs. control)

To explore the data, the 2-tailed Pearson's correlation between each pair of variables, r , was calculated and those which are statistically significant with less than a 5% probability of error, $p < .05$, are shown in figure 1 as arrows and r values with a * sign. Correlation values can range from minus 1.0 to plus 1.0; the further an r value is from 0, the greater is the size of the relationship. Negative correlation values mean that as one variable in a pair increases, the other decreases. Values above 0 mean that as one variable increases, the other variable in the pair also increases.

There were a number of differences in the pattern of correlations, comparing the control sample with the intervention samples, as illustrated in figure 1. One difference was that, in the control sample, group cohesion declined as group conflict increased to a larger extent ($r = -.78$) than happened within the intervention sample ($r = -.55$). Another difference was that, within the control sample, engaging behavior declined as group conflict increased ($r = -.5$) whereas, within the intervention sample, engagement and conflict were not significantly correlated. A third difference between the two samples was that, within the control sample, avoidance behavior increased as the LPC score increased ($r = .35$) whereas, within the intervention sample, avoidance and LPC score were not significantly correlated. Fourth, within the control sample, group conflict substantially increased as collectivist self-construal decreased ($r = -.71$) whereas, within the intervention sample, conflict was not significantly correlated to either type of self-construal. These differences in the pattern of correlations imply that a different system of processes was operating in each sample.

3.2. Comparisons of linear models (intervention vs. control)

In the system of processes illustrated in figure 1A (the control sample), variables appear to be actively inter-related in such a way that a 'good' variable is declining as a 'bad' variable increases (e.g., engaging behavior declines as conflict rises; collectivist self-construal declines as conflict rises). In contrast, in figure 1B, the system of processes appears to be buffered. To test these cumulative effects of the variables measured on student group performance, regression analysis was conducted in split-file mode, testing the same linear model and comparing the two samples. Regression analysis allows a one-way test of the single and combined effects of predictor variables on a criterion variable.

The criterion variable in the regression model was group performance (the mark obtained by the participant's group for the assessment) and the predictor variables were group conflict, engaging behavior in the group, avoidance behavior in the group, group cohesion and LPC score. In the control sample, the regression model was significant, $F(5, 41) = 4.71$, $p = .002$, and the predictors explained over a third (36%) of the variance in group performance, $R^2 = .36$:

[Control cohort]

Group performance = group cohesion + group conflict + avoidance behavior + LPC score

In the control sample, the following variables had unique significant effects as predictors of group performance: group cohesion, $t = 3.95$, $p = .001$, group conflict, $t = 2.76$, $p = .009$, avoidance behavior, $t = -2.07$, $p = .045$, and LPC score, $t = 3.2$, $p = .003$, but not engaging behavior, $t = -4.9$, $p = .626$. On the contrary, in the intervention sample, the regression model was not significant, $F(5, 28) = 1.65$, $p = .179$, and the variance explained lower, $R^2 = .23$. In the intervention sample, the predictor variables entered into the regression analysis had a null effect on group performance: group cohesion, $t = -.47$, $p = .64$, engaging behavior, $t = .45$, $p = .65$, group conflict, $t = 1.65$, $p = .11$, avoidance behavior, $t = .85$, $p = .40$, LPC score, $t = -.65$, $p = .52$. This suggested that the intervention succeeded in preventing a faulty system of processes from impacting on group performance:

[Intervention cohort]

Group performance \neq faulty system of processes

To test the linear effects of the predictor variables after including sources of individual differences, collectivist and individualist self-construal were added as predictor variables in the regression models. The same pattern emerged: in the control sample the model was significant with a sizeable amount of variance in group performance explained, $F = 3.33$, $p = .007$, $R^2 = .37$, whereas in the intervention sample the model was not significant and less variance in group performance was explained by the predictors, $F = 1.61$, $p = .176$, $R^2 = .30$. Again, in the intervention sample, none of the predictors were singularly effective either, for $t p > .10$. As expected, in the control sample the following variables were still significant predictors of group performance: group conflict, $t = 2.51$, $p = .016$, LPC score, $t = 3.16$, $p = .003$ and group cohesion, $t = 3.22$, $p = .003$. Interestingly, avoidance behavior was now no longer a significant predictor in the control sample, $t = -1.87$, $p = .069$, and (similar to the intervention sample) individualist self construal and collectivist self construal had no significant effects on group performance, both $t p > .60$.

These results show that (i) a faulty system of processes had no significant effect on student group performance if there was an intervention and (ii) this remained true even if individual differences in collectivist and individualist self-construal were taken into account.

3.3. Path model of processes (whole sample)

Structural equation modeling is a step beyond linear regression in that it enables a holistic test of effects, some of which happen in sequence. The path (non-factorial structural equation) model that emerged as the best fitting model is illustrated in figure 2, with Bentler-Bonnet Normed Fit Index = .88, Comparative Fit Index = .91, Root Mean Square Error of Approximation = .18. The standardized regression equations from the path model were that: group conflict = $-.77 \times \text{group cohesion} + .23 \times \text{individualist self-construal} + .17 \times \text{intervention} + .66 \text{error}$, producing a group conflict R^2 of .56; secondly, group cohesion = $.73 \times \text{collectivist self-construal} - .19 \times \text{induction intervention} + .65 \text{error}$; producing a group cohesion R^2 of .57; the third standardized regression equation from the path model was that group performance = $.24 \times \text{group conflict} + .4 \times \text{group cohesion} + .96 \text{error}$, producing a group performance R^2 of .08. Therefore, individual differences had no direct effect on group performance; instead, individualist self-construal increased group conflict whereas collectivist self-construal

increased group cohesion. From there, taking into account the intervention's presence, both group cohesion and group conflict benefited group performance, and explained 8% of the variance in students' group performance.

4. Discussion

The first theoretical implication from the findings is that, in the absence of an intervention, a faulty system of processes is in play and it has a significant impact on student group performance. In the control cohort, there were active relations among variables in a way that can be problematic, with 'good' variables declining as 'bad' variables rose; for example, engaging behavior declined as group conflict increased, collectivist self-construal declined as group conflict increased, and group cohesion declined quite strongly as conflict rose. These cumulative effects significantly predicted group performance within the control sample. In contrast, following an intervention, there appeared to be a buffered system in play; for example, group cohesion increased as avoidance behavior increased, group performance increased as conflict increased, engaging behavior was uncorrelated with conflict, and collectivist self-construal was also uncorrelated with conflict. The cumulative effects did not have a significant impact on group performance within the intervention cohort, unlike in the control cohort. The second theoretical implication is hence that the intervention produced a buffered system: taking into account the intervention's presence, both group cohesion and group conflict benefited group performance. Individualist self-construal activated conflict whereas collectivist self-construal activated cohesion but the intervention worked as a buffer, meaning that both cohesion and conflict were then beneficial to group performance. We will now consider how the induction protocols buffered against motivation losses, coordination losses and harmful group dynamics.

4.1. Induction protocols as buffers against faulty processes

The induction pre-empted motivational problems that produce social loafing because of the feeling of 'diffused responsibility' (Latane et al. 1979); this happened through a group log and a clause within a group contract that emphasized each individual's accountability to the group. The group log was a 2-page document kept by each group to record each individual's attendance of group meetings

and the group contract was a 2-page document filled in by each group with clauses on each individual's task responsibilities, and on penalties that could result from non-attendance or under-performance by an individual member. The penalties were decided upon by each group; examples of penalties included an individual member having to do extra work, the group requesting mediation by the tutor, or removing the member from the group. Task importance and evaluation potential at the group level (the expectation that the group's performance will be assessed) were high because all students in the experiment were doing group work that would contribute to their course/degree marks. What was left for the intervention to do was to introduce 'process accountability' (Scholten, van Knippenberg, Nijstad & De Dreu, 2007) of the group – the scrutiny that groups could expect. This was done by providing 'process feedback' (Geister, Konradt & Hertl, 2006) when groups were asked to draft their group contract and gain advice during the workshop and consultation session early in the term. Groups were also asked to submit their group logs and their group contract to the tutor on the day of the group assessment. Although the contract and log were not formally marked, groups within the intervention sample could expect not just their performance but also the process of their group work to be under scrutiny.

The group contract utilized in the current intervention had a clause on meetings and other elements of coordination, such as requiring each group to choose a leader (dubbed the 'team captain'). Through a lecture on group productivity, and a consultation session on the same, team captains were asked to facilitate task division and temporal planning, which is essential in group coordination (Janicik & Bartel, 2003). A process-directive leadership style (based on evidence by Peterson, 1997) was also encouraged; for example, the captain was responsible for leading the write-up of the group contract and keeping the group log. To prevent autocratic leadership styles, the group contract asked groups to indicate whether their captain had been democratically chosen, whether he/she could be removed from leadership, and whether he/she had more power than other members. In the introductory lecture, groups were encouraged to elect their team captain democratically. During a workshop on group productivity in which groups drafted their group contract, they received advice on the leadership clause from the tutor. Specifically, they were told the benefits of stipulating that the leader *could* be removed and that the leader ought to have no more power than other members. Therefore, in summary, through the introductory lecture, through a workshop on group productivity,

and in pointers within the group log and group contract, it was made clear that the team captains were being urged to be both democratic and process-directive.

Optimizing information sampling was done through a workshop whereby students sketched ideas for their group contracts and received advice on optimal information sharing. The introductory lecture recommended that individual members within each group should formulate their own opinions/ideas before a group meeting and then take these to the group for a discussion. This tied in with an effective remedy, which is making information searches heterogeneous (meaning that searches are conducted by individuals, Schultz-Hardt, Frey, Moscovici & Luthgens, 2000). Groups were encouraged to be specific about information gathering tasks allocated to an individual; for example, specific bibliographic database search parameters should be agreed by the group. Additionally, groups were encouraged to use online platforms to share information. Most or all set up group pages on 'Facebook', enabling fairly thorough and immediate sharing of literature references, web links, ideas, questions and plans from day-to-day. This intervention also served as a way of preventing novel information presented by one member from having a disproportionate impact because in-depth information sharing ensured that any given information ceased to be regarded as novel and one individual member could not be regarded as the sole expert.

The prevention of norms which are harmful to the quality of group decision-making was inherent in the task (preparing for a structured debate) given to students within the intervention sample, since each group was defending a debate statement dialectically opposite to that of another group. Groups were therefore expected to exhibit few groupthink symptoms (defined by Janis & Mann, 1972) and to exhibit disagreements or other behaviors that are antidotes to groupthink. This would explain why group conflict positively predicted performance. The introduction lecture advised groups to repeatedly evaluate the limitations of their arguments and evidence from the point of view of the opposite group. These techniques can be implemented by students doing other sorts of group work, such as by dedicating a portion of each meeting to applying Greitemeyer et al.'s (2006) 'dialectical technique': contriving dissent or disagreement about an idea, to unearth its disadvantages. The intervention also encouraged norms of task-orientation within each group by encouraging a business-like approach of placing greater preference on tasks than on interpersonal relations, such as by not suppressing task-related disagreements or expressing a differing opinion.

In terms of the individual differences measured, there was no evidence that individualist and collectivist self-construal were antagonistic concepts, even though the cultural context of the study is thought to be primarily individualist (Hoftsede, 1980). Instead, the two forms of self-construal were orthogonal and co-existed within each individual in both the intervention and control samples, supporting emerging trends in theories about collectivism and individualism (e.g., Heine et al., 2002; Oyserman & Lee, 2008) which suggest that the important differences are within rather than between cultures. The individual differences measured in the present study (individualist and collectivist self-construal) had no direct effect on performance, although they predicted group conflict and cohesion, which then predicted performance. A follow-up study should include data from different cultures, include international students, vary the level of study (undergraduate/postgraduate) and take into account the culture of the institution, to corroborate the conclusion that group assessments activate collectivist self-construal in any cultural setting.

There are other important individual differences and therefore future research should explore the role of personality and emotional style; a follow-up experiment should explore their activation according to situational variables created by the group's activities. A second crucial area of further research is to tap into the complexity surrounding the assessment of group work (Nordberg, 2008) because the assessment process has important psychological implications. In the intervention cohort, 25% of each group's performance was assessed by peers, and the rest by two tutors, whereas in the control sample 100% of group performance was assessed by tutors. Therefore, a follow-up experiment should randomize this, ensuring that peer-assessment existed in both the control and intervention samples. Many students express the preference that group work should include peer-assessment (Pond, Coates & Palermo, 2007) and the way in which group work is assessed has implications for students' perceptions of the fairness of the process (Nordberg, 2008). That can, in turn, shape motivational losses or gains. At the same time, peer-assessment can introduce competition or else 'meta-cohesion' across different groups in one cohort, given there is evidence of collusion between some students during peer-assessment (Pond et al., 2007). Thirdly, future research should explore the role of institutions and collaborations among tutors in supporting the interventions. One promising cross-institutional initiative was the 2001-2004 GWAMP project (see CEMP, 2013), which involved sharing good practice about student group work across several institutions. It will be pragmatic for tutors leading different units or courses to adopt this kind of collaborative approach

when organizing student group inductions; it will also be essential for institutions to provide the resources and support needed by such initiatives.

5. Conclusion

Student groups, like many groups, are at risk of suffering productivity deficits. This is consequential in educational settings, as in other settings, and it is important that the output of the group is reflective of its input, rather than the process losses that arose along the way. Interventions to optimize student group performance were implemented, including the use of a group log, the creation of a group contract, the choosing of a team captain, a taught session on the psychology of group productivity and decision-making, a workshop applying that knowledge, a consultation session to advise on the group contract contents, the use of online platforms to optimize information sharing, and the offer of mediation by the tutor (where needed) to resolve group conflict. A separate study was then conducted, yielding a sample of students from the intervention cohort, and a control sample of students. In the absence of an intervention, a faulty system of processes was active and had a statistically significant impact on group performance (the mark obtained for the group assessment). The opposite was true in the intervention sample. The intervention produced a buffered system whereby group climate was beneficial to group performance. Although a follow-up experiment should measure the individual efficacy of each intervention implemented, this study demonstrated a promising application of existing knowledge to help optimize group performance in educational settings.

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Figure 1:

Figure 1 Caption.

Figure 1A shows the pattern of correlations within the control sample whereas figure 1B shows the pattern within the intervention sample.

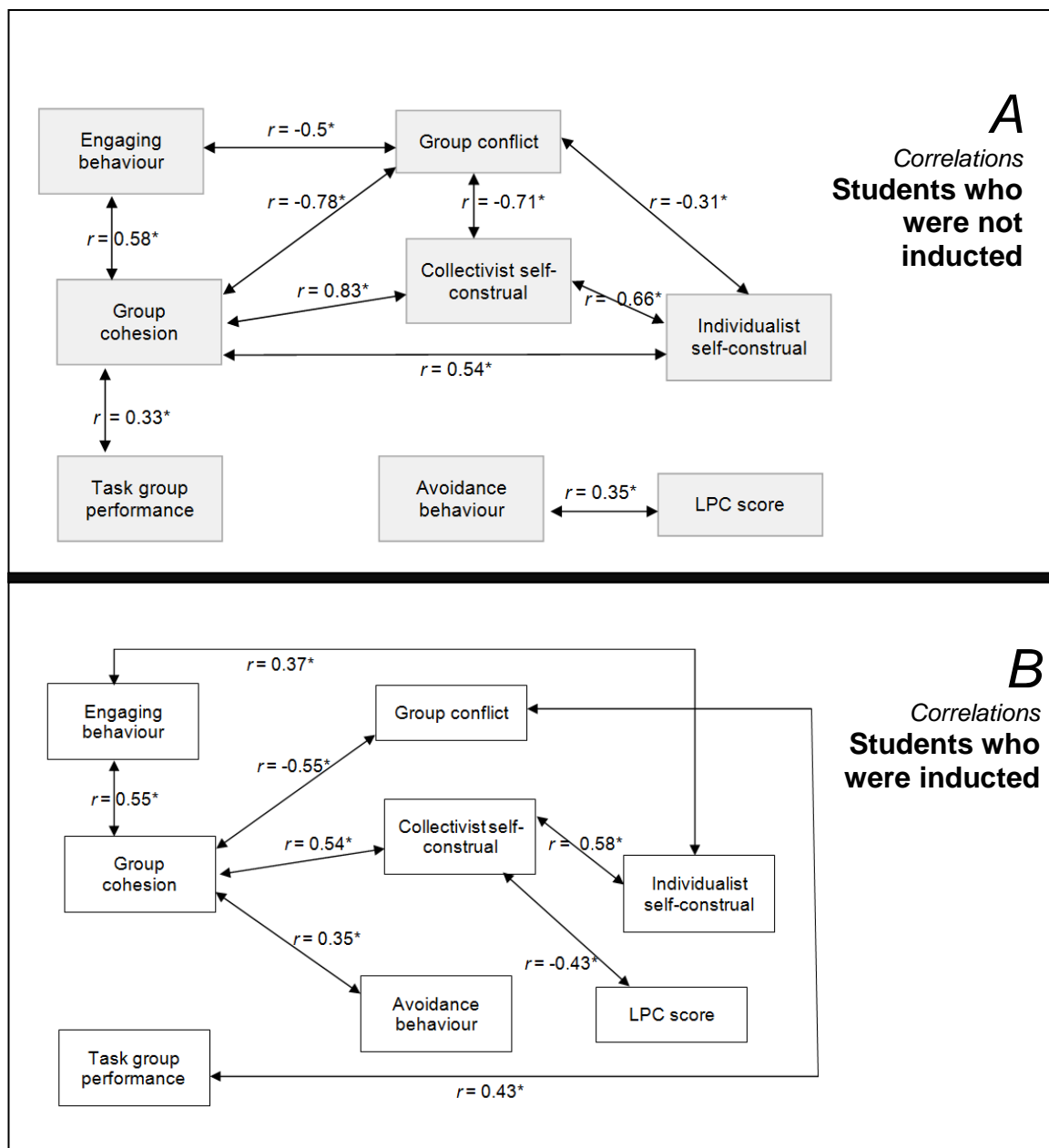


Figure 2:

Figure 2 caption:

The path analysis results

