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## Quantification of Influences on Student Perceptions of Group Work

### Abstract

How students perceive group work is closely correlated with the benefits of group work experience. However, a great variety of influences affect student perceptions of group work. This study quantifies the impact of various influences on the effective working, learning assistance and enjoyment of group work. This is done by analysing 206 responses to a survey of students in a course in actuarial science. A mixed ordered logit model is used to explicitly quantify the effect of various exogenous and endogenous influences on perceptions of group work. Student perceptions of group work are most heavily influenced by course design decisions regarding the scaffolding provided to groups, the expectation about whether or not they will enjoy group work, and their role undertaken in the group, including their level of effort (but not quality) relative to other group members. Implications for teaching practice are discussed.

### Keywords

Higher education, group work, teamwork, communication, training

## Introduction

The positive impact of group work on the learning experience of students in higher education is widely documented (see, for example, the meta-analyses of Springer, Stanne & Donovan 1999; Gibbs 2009), with students perceiving a wide variety of benefits ranging from deeper learning to increased communication and teamwork skills being (Volkov & Volkov 2015). Research has also shown that the observed correlation between student satisfaction with group work and effective group performance (Springer, Stanne & Donovan 1999) depends on a positive student perception of group work.

This paper adds to the literature on student perceptions of group work in two ways. First, three dimensions of perceptions of group work are investigated: effectiveness of how well the group worked together, assistance in learning from group work and enjoyment of group work. Second, a mixed ordered logit model is used to explicitly quantify the impacts of a comprehensive list of exogenous and endogenous influences on student perceptions. This is done by quantitative analysis of responses to a survey of students taking a course in actuarial science with a significant group-work component, using supplemental quotes from open-ended response questions where appropriate. The survey considers perceptions both before and after the group-work activities, allowing analysis of expectations prior to the group-work experience.

An exploratory approach is used, as a large number of influences on perception of group work are considered and it is desired to explore the survey response dataset without any pre-conceived research questions or hypothesis attached. The results are then used to comment on practical implications for the use of group work in university teaching.

## Influences on group work perceptions

As stated in the introduction, research has shown the benefits of group work and the importance of student perceptions of group work to the group-work experience. Despite this, there is not a great deal of previous research that has attempted to quantify the variety of influences on student perceptions of group work, and findings are typically focused on a small number of influences, with results being decidedly mixed. In this paper we look at a wide variety of potential influences and aim to identify which are the most significant. Furthermore, whilst some of the surveys used in the literature ask a variety of questions on perceptions of group work, these papers typically group the responses in some way rather than differentiating between the three dimensions of group-work perceptions, as in this paper. The remainder of this section presents a summary of the literature across these considerations, so that we might compare our results to the literature and discuss implications for practice.

Looking at exogenous influences in the literature, Gatfield (1999) investigates student satisfaction with group work across a number of influences, finding that international students and those with work experience favour group work, and that gender and age have no impact on satisfaction. Ro and Choi (2011), however, use an exploratory factor analysis to find that females have more negative perceptions of teamwork than males, and suggest groups be allowed to self-select to mitigate this concern. Summers and Volet (2008) find that students working in culturally mixed groups have similar perceptions of group work to those working in non-diverse groups; however, Moore and Hampton (2014) find that domestic students tend to prefer to working with students of similar background, whilst international students do not have such a preference. Payne, Guastaferrero and Mummert (2011) find that students with significant prior group-work experience

tend to have a more positive attitude to future group-work experiences. Espey (2010) finds that high-performing students (based on grade point average) have a poorer perception of group work.

Looking at endogenous influences, Pfaff and Huddleston (2003) find that the students' grade in the project is the strongest predictor of perception of a recent group-work activity, with balanced workload/time factors also being significant. They suggest that ensuring that group-work activities have an appropriate workload/time balance and giving students the opportunity to provide feedback on group members are important factors for success. Burdett and Hastie (2009) find that perception of learning of group-work skills is the strongest predictor of overall satisfaction with group work, and that workload imbalance is a significant predictor of dissatisfaction with group work. They suggest that group assessment tasks be designed to allow clear collaboration and be time-manageable with other courses, with group members having clear accountability through peer assessment. Lamm, Carter and Melendez (2014) find that intrinsic motivation for the task to be undertaken is the biggest single predictor of group-work satisfaction; similarly, Hannaford (2017) finds that expectations of the success of group work and the perceived value of the task have a significant impact on perceptions of group work. Thus designing the assessment task that is to be completed in groups so that it is intrinsically motivating is helpful to group-work success.

From a methodological perspective, looking at literature that attempts to quantify the impact of multiple influences, as this paper does, Espey (2010) uses a probit model using endogenous influences only. Pfaff and Huddleston (2003) perform a stepwise multiple linear regression with predictors grouped together by factor analysis on a range of questions related to perceptions of group work. Burdett and Hastie (2009) use a similar approach. As in this paper, Bravo, Catalán and Pina (2018) use three measures of group-work perception: "perceived learning (in the course)", "expected quality (of the group's work)", and "satisfaction with teamwork". They then model this using an input-process-output approach that centralises team cohesiveness (measured by a range of individual and task factors) as the only predictor of satisfaction, along with other exogenous influences such as gender and domesticity. They suggest that instructors can improve team cohesiveness by designing appropriately sized tasks and explaining the value of collaboration for future careers.

Despite these examples, in many cases the literature does not attempt to provide concrete insight into teaching practice. An important goal of this paper is to use the quantitative results from the three clearly separated group-work dimensions to provide additional insight.

## **Study methodology**

### ***Implementation of group work***

Group work was implemented in 2013 in a compulsory course ("the course"), which is co-taught for undergraduate and postgraduate students taking a degree in actuarial science at the author's university. The group-work design was informed by the literature (see above and in this section) and the overarching goals of the course. Students were randomly assigned into groups of four or five, although assignment was controlled to ensure that each group had approximately equal numbers of students across various demographic and academic characteristics. Whilst there is evidence of greater student satisfaction with self-selection of groups (Chapman et al. 2006), the reason for this approach was to challenge students to work with colleagues with whom they were unfamiliar, whilst also ensuring that groups had a diversity of skills and abilities (Oakley et al. 2004; see also the "Academic Selection" approach described by Mantzioris & Kehrwald 2014).

These groups were required to complete two large assignments worth 30% each of the overall grade for the course. These assignments functioned as a capstone (Dunlap 2005) to learning previously undertaken by students and were designed to be intrinsically motivating due to the opportunity to put theory into practice. An individual final examination made up the remaining 40% of the grade.

Other decisions about the learning environment (Oakley et al. 2004) and instructor involvement (Bailey, Barber & Ferguson 2015) were made in such a way as to maximise the possibility of successful group work. Students were given training in specific workshops on how to work in groups (Hamlyn-Harris et al. 2006; Kamau & Spong 2015). This included being required to set rules for their group, and deciding upon a regular meeting time (Senior et al. 2010). Furthermore, groups were also trained in effective communication strategies for group work, and encouraged to think of the different roles and functions required for groups, including selection and/or rotation of these roles (Cohen & Lotan 2014). Lastly, groups were provided with training on producing a project timeline to assist with planning and task allocation for the assignments. To ensure sufficient support, group consultants, who were staff or graduates with significant actuarial experience, were allocated to each group to provide guidance (Burdett 2007).

Group members received the same mark for an assignment. Whilst there is much research on techniques to allocate individual marks in a group task (for example, Spatar et al. 2015), it was felt that since the group project involved delivering a single report to the fictitious client, an important part of the group-work experience was for all group members to take ownership of the whole project and have at least an oversight of all parts of the project. To reduce instances of “free-riders” (Hall & Buzwell 2013), all students were required to complete a survey at the completion of both assignments rating the effort (not quality) of all group members, the results of which led to the reduction of individual marks for some students. Furthermore, the final examination consisted of two questions that were structured as addendums to the two assignments. Hence, students who had put in sufficient effort to understand the assignments would be comfortable in completing the examination, whilst those who had not would struggle with the examination.

The structure for the course was similar in 2014 and 2015 to its structure in 2013, although in 2014 and 2015 separate groups were allocated for the two assignments to ensure that groups who struggled academically or interpersonally were not required to complete the two assignments together. Additionally, in 2014 and 2015 a pro-forma set of group rules was provided to groups as a starting point for their consideration of group structure. In 2015 two separate examinations were held rather than a single final examination, ensuring that the exam question relating to the first assignment was held closer to the completion of that assignment.

### ***The survey instrument and analysis***

All students enrolled in the course in the three offerings over 2013-2015 were invited through their student email address to complete a survey about their perceptions of the group work in the course, with reminders being made in class. No incentives were provided for completion of the survey. Students were invited to commence the survey at the start of the semester. Initially, information on demographics, previous experience and expectations of group work was collected. Later, information was collected on the students’ experience of group work in the course. This structure had the advantage of allowing respondents to separately report past experience/expectations before a significant period of group work, and group-work experience after. In 2014 and 2015 respondents reported their experience of group work separately for the two groups in which they participated. Further information on the survey, including a full list of the questions asked, is

available from the author on request. Table 1 provides information on the survey distribution over 2013, 2014 and 2015.

**Table 1. Survey completion data**

Year	2013	2014	2015	Total
Number invited	125	183	143	451
Initial attempted <sup>^</sup>	104	149	105	358
Partial completion <sup>*</sup>	68	86	54	208
Full completion <sup>§</sup>	38	34	13	85

<sup>^</sup> Answered at least one survey question but provided no information useful for analysis in this paper.

<sup>\*</sup> Did not answer all questions but answered sufficient questions that their response was useful for analysis in this paper.

<sup>§</sup> Answered all survey questions (with the possible exception of some of the non-compulsory open-ended questions).

Only data from partially or fully completed responses were analysed. The key response variables for perception of group work in the course were the answers to the following three questions:

- I believe my group **worked effectively** together in the course.
- I found that working with my group in the course **assisted my learning**.
- I **enjoyed** working with my group in the course.

Answers were given on a Likert scale where 1 = Strongly Disagree, 2 = Partly Disagree, 3 = Neither Agree nor Disagree, 4 = Partly Agree and 5 = Strongly Agree.

After considering basic summary statistics, the effect of influences on perceptions of group work was quantified using a mixed ordered logit model (using the “clmm” function from the R package “ordinal”). Separate models were fit for the three separate perception dimensions described above. The model was defined as:

$$\Pr(Y > j) = \frac{e^{X\beta - k_j}}{1 + e^{X\beta - k_j}}, j = 1, 2, 3, 4;$$

where  $Y$  is the categorical response from the Likert scale described above and  $X$  is the vector of influences (Table 4). Interpretation of the model output is introduced in the next section (Table 5).

The nature of the response variables naturally lend themselves to an ordered logit model, which is an advantage over the approaches used previously in the literature as it allows explicit quantification of the impact of explanatory variables on the group-work perception dimensions in terms of the Likert-scale responses. The model is mixed as respondents in 2014 and 2015 provided their perception of group work for both groups they worked with, which were treated as two separate observations. This gave a total of 290 observations in fitting the models.

## Results

### *Respondent demographics*

Table 2 presents demographic details of respondents; it shows, among other things, that a strong majority of respondents were international students who came from non-English-speaking

backgrounds. These proportions are higher than the overall proportions in the course, due to a higher response rate from these students.

**Table 2. Respondents' demographic details**

<b>Year</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>Total</b>
<b>What is your gender?</b>				
Female	34	37	31	102
Male	34	49	23	106
<b>What degree program are you enrolled in?</b>				
Undergraduate	44	50	33	127
Postgraduate	24	36	21	81
<b>Is English your primary language of communication outside of university?</b>				
Yes	27	23	13	63
No	41	63	41	145
<b>Are you a domestic or international student?</b>				
Domestic	24	23	13	60
International	44	63	41	148
<b>What is your age (in complete years)?</b>				
20 or less	5	3	2	10
21	14	23	7	44
22	16	20	12	48
23	13	15	18	46
24	8	17	10	35
25 or greater	12	8	5	25

### ***Summary statistics of group-work perceptions***

Table 3 presents summary statistics on the participants' previous experience of group work, and comparisons between prior experience, expectations and experienced perceptions of group work undertaken in the course, grouped across dimensions. Given that the purpose of this paper is to discuss influences on student perceptions of group work, and in the interests of brevity, comments on Table 3 are kept to a minimum.

The data shows that the vast majority of respondents had experience with group work prior to the course, but less than 10% of respondents had been trained in working as a group. Overall experience, expectations and perceptions of group work across all dimensions were positive compared to a neutral rating of 3, which is consistent with the literature (Gatfield 1999; White et al. 2005; Espey 2010). In general terms, students perceived that the learning benefits of working in a group were greater than how well their group worked together and how much they enjoyed working in a group.

One important point worth noting is that, not unexpectedly, there were significant correlations between the perception dimensions of the group work in the course, with Worked Effectively/Enjoyed, Assisted Learning/Enjoyed and Worked Effectively/Assisted Learning having Pearson correlation coefficients ("correlation") of 0.78, 0.76 and 0.65, respectively. However, there was not such a strong correlation between perception dimension responses from the same student across their two separate group work experiences, with correlations of 0.20, 0.32

and 0.28 for Worked Effectively, Assisted Learning and Enjoyed, respectively. This affirms student concerns over the impact of the composition of the group (Chapman et al. 2006).

**Table 3. Past experience, expectations and perceptions of group work**

Year	2013	2014	2015	Total
<b>Have you had experience with group work in your past education?</b>				
Yes	43	61	29	133
No	11	6	3	20
<b>Did you receive any training in teamwork prior to the group work activities? (for those who answered "Yes" to the previous question only)</b>				
Yes	3	8	1	12
No	40	53	28	121
<b>In my past experience of group work, the groups I have been a part of have worked effectively together</b>				
Likert average*	3.95	4.19	3.86	4.03
<b>I believe my group worked effectively together in the course</b>				
Likert average*	3.25	3.86	4.07	3.77
<b>I believe my past experience with group work was beneficial to my learning at that time</b>				
Likert average*	3.95	4.26	3.71	4.03
<b>I believe that the use of group work in the course will assist in my learning during the course</b>				
Likert average*	3.88	3.97	3.83	3.91
<b>I found that working with my group in the course assisted my learning</b>				
Likert average*	3.43	4.22	4.16	4.08
<b>I enjoyed my past experience with group work</b>				
Likert average*	3.66	3.87	3.54	3.72
<b>I believe I will enjoy the group work in the course</b>				
Likert average*	3.56	3.70	3.62	3.63
<b>I enjoyed working with my group in the course</b>				
Likert average*	3.12	4.08	3.94	3.82

\* Provides the average score on a Likert scale where 1 = Strongly Disagree, 2 = Partly Disagree, 3 = Neither Agree nor Disagree, 4 = Partly Agree, 5 = Strongly Agree.

NB: A question on expectations of working effectively as a group was not asked.

### **Quantification model output**

Whilst determining the statistical significance of coefficients in a mixed ordered logit model is simple, interpretation of the coefficients is difficult in isolation. Therefore, to demonstrate the magnitude of the impact of the various influences, a synthetic individual was created for which a base series of influences were set, before testing the impact that individually changing each of the influences to an alternative value had on the perception dimensions. Table 4 presents the influence definitions, along with base and alternative values for the synthetic individual. Table 5 shows the output pertaining to the mixed ordered logit model. Influences on group-work perception are now discussed across different themes, including their implications for teaching practice.



**Table 4. Influences and synthetic individual definitions**

Influence	Definition	Synthetic Individual Base Value	Synthetic Individual Alternative Value
<i>(i) Course Design</i>			
Yr2014	1 if Year is 2014, 0 otherwise	0	1
Yr2015	1 if Year is 2015, 0 otherwise	0	1
Group2	1 if 2 <sup>nd</sup> group, 0 otherwise	0	1
<i>(ii) Demographics</i>			
Gender	1 if female, 0 if male	0	1
Degree	1 if postgraduate, 0 if undergraduate	0	1
Language	1 if English is not primary language used, 0 if English is primary language used	0	1
Location	1 if international student, 0 if domestic student	0	1
Age	Numeric integer of age in years	21	23
<i>(iii) Past Experiences and Expectations of Group Work</i>			
PastGrade	Numeric integer of average grade in past courses	60	75
PastExp	1 if had previous group work experience, 0 if not (see Table 3)	0	1
PastTrain	1 if had been trained during previous group work experience, 0 if not (see Table 3)	0	1
PastWorkEff	Likert scale on past experience of group working effectively together (see Table 3)	3	5
PastLearn	Likert scale on past experience of learning in group work (see Table 3)	3	5
PastEnjoy	Likert scale on past experience of enjoyment of group work (see Table 3)	3	5
ExpLearn	Likert scale on expectations of learning in group work (see Table 3)	3	5
ExpEnjoy	Likert scale on expectations of enjoyment of group work (see Table 3)	3	5
<i>(iv) Group Interaction</i>			
SharePerson	Frequency <sup>^</sup> with which group shared ideas in person	1	2
ShareSkype	Frequency <sup>^</sup> with which group shared ideas via Skype or equivalent	1	2
ShareSM	Frequency <sup>^</sup> with which group shared ideas via social media	1	2
ShareMoodle	Frequency <sup>^</sup> with which group shared ideas via the course learning management system	1	2
ShareDB	Frequency <sup>^</sup> with which group shared ideas via DropBox or equivalent	1	2
RulesUpd	Frequency <sup>^</sup> that the group updates their group rules	0	1
ConsultFreq	Number of times group met with group consultant for an assignment	1	2
<i>(v) Individual Functioning in the Group</i>			
RoleFacil	Frequency* that the role of group facilitator was undertaken	0	1
RoleTime	Frequency* that the role of timekeeper was undertaken	0	1
RoleRec	Frequency* that the role of recorder was undertaken	0	1
RoleDA	Frequency* that the role of devil's advocate was undertaken	0	1
AssignEff	Likert scale <sup>§</sup> on how much effort put in compared to other group members	3	5
AssignQual	Likert scale <sup>§</sup> on quality of work compared to other group members	3	5
<i>(vi) Group Work Outcomes</i>			
AssignMark <sup>#</sup>	Numeric integer of assignment mark for the group worked in	60	75
ExamMark <sup>+</sup>	Numeric integer of mark for the individual exam following the assignment	50	75

<sup>^</sup> "Never" = 0, "Very occasionally" = 0.25, "Once per fortnight" = 0.5, "Once per week" = 1, "Twice per week" = 2, "More than twice per week" = 3.

\* "Never" = 0, "Very occasionally" = 0.25, "Sometimes" = 0.5, "Most of the time" = 0.75, "All of the time" = 1. See Carnegie Mellon University (2017) for a full description of roles.

<sup>§</sup> 1 = Significantly less, 2 = Slightly less, 3 = About the same, 4 = Slightly more, 5 = Significantly more

<sup>#</sup> For students in 2013 this is the mark for Assignment 1 only.

<sup>+</sup> Asked only in 2015.

**Table 5. Mixed ordered logit model outputs**

Influence	Worked Effectively		Assisted Learning		Enjoyed	
	Exp( $\beta$ )	Likert average	Exp( $\beta$ )	Likert average	Exp( $\beta$ )	Likert average
<b>Base result</b>		<b>3.297</b>		<b>3.756</b>		<b>3.726</b>
<i>(i) Course Design</i>						
Yr2014	2.955***	3.930	3.415***	4.334	6.025***	4.525
Yr2015	6.526***	4.305	3.297**	4.320	7.162***	4.580
Group2	0.318***	2.544	0.614	3.476	0.317***	3.025
<i>(ii) Demographics</i>						
Gender	0.549**	2.905	0.945	3.725	0.629	3.459
Degree	1.051	3.329	1.266	3.881	1.485	3.934
Language	0.906	3.234	0.449*	3.280	0.839	3.628
Location	0.842	3.187	0.906	3.702	0.513*	3.334
Age	0.940	3.218	0.903	3.643	0.822**	3.502
<i>(iii) Past Experiences and Expectations of Group Work</i>						
PastGrade	0.973	3.033	1.004	3.780	0.999	3.718
PastExp	0.646	3.012	0.452	3.284	0.671	3.498
PastTrain	0.310**	2.257	0.742	3.088	1.279	3.641
PastWorkEff	1.452	3.747	0.837	3.555	1.172	3.895
PastLearn	1.276	3.597	1.540	4.181	0.848	3.540
PastEnjoy	0.881	3.134	1.189	3.936	1.102	3.830
ExpLearn	0.725	2.876	0.877	3.609	0.887	3.592
ExpEnjoy	1.888**	4.026	2.089**	4.428	2.087***	4.410
<i>(iv) Group Interaction</i>						
SharePerson	1.540**	3.565	1.170	3.840	1.461**	3.926
ShareSkype	1.212	3.419	1.046	3.780	1.313*	3.871
ShareSM	1.228	3.427	1.452***	3.950	1.112	3.784
ShareMoodle	1.276*	3.451	1.284*	3.888	1.348**	3.885
ShareDB	1.147	3.384	1.249*	3.873	1.143	3.799
RulesUpd	0.857	3.197	1.352	3.914	1.084	3.770
ConsultFreq	1.027	3.314	0.942	3.723	0.965	3.707
<i>(v) Individual Functioning in the Group</i>						
RoleFacil	0.985	3.288	0.504	3.354	0.262**	2.898
RoleTime	3.770**	4.054	3.073*	4.292	5.965***	4.522
RoleRec	0.783	3.139	0.730	3.579	0.763	3.573
RoleDA	1.371	3.495	1.284	3.888	1.523	3.947
AssignEff	0.401***	2.128	0.537**	2.986	0.407***	2.594
AssignQual	0.980	3.272	1.083	3.841	0.874	3.574
<i>(vi) Group Work Outcomes</i>						
AssignMark	1.026*	3.531	1.017	3.890	1.019	3.878
ExamMark	1.020	3.606	1.011	3.901	1.024	4.035

\*\*\*, \*\*, and \* are significant at the 1%, 5% and 10% level, respectively.

The exponential of the  $\beta$ s ("Exp( $\beta$ )") is provided for consistency with the model construction. A value less than 1 indicates that the variable has a negative impact on the group-work perception dimension, whilst a value greater than 1 indicates that the variable has a positive impact. The base result "Likert average" is the expected value of the perception dimension from the model for the synthetic individual base values of influences in Table 4. The other "Likert average" values show the expected value of the perception dimension of a change in that influence from the base value to the alternative value (holding all other values at base levels). For example, for the synthetic individual, the Likert rating was expected to increase from 3.297 to 3.930 in perceptions of working effectively as a group in 2014 compared to 2013.

**(i) Influence of course design**

The positive results of the changes made between 2013 and 2014 can be seen with p-values < 0.01 for almost all group-work perception dimensions (“Yr2014”, “Yr2015”). This demonstrates the importance of the design and scaffolding of group work (Oakley et al. 2004; Hamlyn-Harris et al. 2006; Bailey, Barber & Ferguson 2015) and, in this case, the benefits of specific pro-forma rules to assist group structure. However, significant reductions in perceptions of Worked Effectively and Enjoyed were noted in the second group (“Group2”), remembering that students were allocated to a separate second group in 2014 and 2015 only. These negative impacts were similar in scale to the positive impacts of 2014 and 2015, suggesting that group-work fatigue may have set in within the second groups, although the reduction in Assisted Learning in the second group was much less. Additionally, effective group work may have been much harder in the second half of the semester, with a greater workload being experienced in other courses (Beard, Clegg & Smith 2007), illustrating the importance of instructors being aware of the load placed on students when designing group work.

**(ii) Influence of demographics**

Demographic influences tended not to be as strong as those of course design. Females (“Gender”) more strongly believed that their groups did not Work Effectively together compared to males (p-value < 0.05), consistent with Ro and Choi (2011). A similar but not statistically significant coefficient was also present for female Enjoyment of group work, although females believed group work Assisted Learning to the same extent as males. The female experience of group work is of concern and should be considered in course design.

The influence of degree type (“Degree”), primary language (“Language”), domesticity (“Location”) and age (“Age”) was somewhat complicated by significant correlations between the influences, therefore giving lower p-values even when the coefficient impact was quite large. The three largest correlations were between “Language” and “Location” (0.57), “Degree” and “Age” (0.52) and “Degree” and “Location” (0.39). The most significant influence was age on group work Enjoyment (p-value < 0.05). International students (“Location”) Enjoyed group work less than domestic students (p-value < 0.10), which is inconsistent with Gatfield (1999). Furthermore, English as a secondary language students (“Language”) perceived that group work did not Assist Learning more strongly than other students (p-value < 0.10). Degree type had a moderating (but not statistically significant) influence, with postgraduate students having positive perceptions of group work across all dimensions. It can be concluded that undergraduate international students had the poorest perception of group work. Given that the group work in the course required students to work with those of different backgrounds, this is inconsistent with the findings of Moore and Hampton (2014) that international students are more willing to work in culturally diverse groups than domestic students. However, the evidence was not strong, and the findings of this paper were insufficient to recommend any impact on teaching practice.

No influence of prior grades (“PastGrade”) on perceptions of group work was seen, inconsistent with the findings of Espey (2010).

**(iii) Influence of past experiences and expectations of group work**

Given that almost all students had experienced group work in the past (“PastExp”) but very few had been trained in group work (“PastTrain”) (Table 3), it is unsurprising that these influences

tended to not be statistically significant predictors of group-work perceptions, and are hence not discussed further.

Significant correlations existed between prior experience and future expectations of group work across the dimensions. Perceptions on prior experience of working in a group (“PastWorkEff”, “PastLearn” and “PastEnjoy”), plus expectations of group work (“ExpLearn” and “ExpEnjoy”) were all highly correlated. The highest correlation was between “PastLearn” and “PastEnjoy” (0.71), whilst the lowest correlation was between “PastLearn” and “ExpEnjoy” (0.53). That said, it is clear that the biggest influence on group work perception in the course by far was whether group work was expected to be enjoyed, with  $p$ -value $<0.01$  for Enjoyment and  $p$ -value $<0.05$  for Working Effectively and Assisting Learning. Unlike demographics, the other correlated influences did not provide a strong moderating impact across the dimensions. In any case, given the correlations between influences, these results are broadly consistent with Hannaford (2017).

Further on this topic, respondents were asked an open-ended question requesting them to explain their expectations of enjoyment of the course. Students who expected to enjoy group work were cautious, but optimistic, many of them sharing that their group-work experience was likely to be largely influenced by their group members:

*I do not know, if my team member is good, I think it would be well, if not, yes, I believe it would be tough.*

This is consistent with the relatively low correlation between perception dimension responses from the same student across their two separate group work experiences, as discussed in relation to Table 3. However, students who did not expect to enjoy group work were instead much more certain of the likelihood of a negative experience:

*I think I'll have to do everything, as I generally do in group assignments.*

The influence of expectations of enjoyment demonstrates the importance of the instructor creating a learning environment that focuses on the positive aspects of group work, as prior impressions about group work may be difficult to break.

#### **(iv) Influence of group interaction**

Increased frequency of interaction (“SharePerson”, “ShareSkype”, “ShareSM”, “ShareMoodle” and “ShareDB”) had a positive influence on group-work perception across all dimensions. The method of sharing affected different dimension perceptions in different ways.

Meeting more frequently in person (“SharePerson”) was associated with perceptions of Working Effectively as a group ( $p$ -value $<0.05$ ) and Enjoyment of group work ( $p$ -value $<0.05$ ). More-frequent sharing on social media (“ShareSM”) was associated with perceptions of group work Assisting Learning ( $p$ -value $<0.01$ ). More frequent sharing via Skype or equivalent (“ShareSkype”), the course learning management system (“ShareMoodle”) and DropBox or equivalent (“ShareDB”) were also associated with positive perceptions of group work in one or more dimensions. This demonstrates the importance of the instructor mandating and/or encouraging frequent group interactions. Neither the frequency of updating group rules (“RulesUpd”) nor meeting with the group consultant (“ConsultFreq”) showed any significant influence.

Further to this topic, survey respondents were asked using open-ended questions to explain their perceptions of group work in the course across the dimensions. Positive perceptions of group work were regularly linked to cohesiveness and proper communication:

*I do think we worked effectively for Assignment 1. Everyone respected and listened to each other's ideas. All decisions were made with the consensus of the entire group. Furthermore, we had very efficient means of communication via Dropbox and Facebook, which meant that all group members were frequently updated on the progress of the report.*

*My group worked very effectively together. We all wanted to achieve the same ultimate outcome so this drove us to go above and beyond and work well. We also helped other members that were having difficulties which made us a stronger group.*

Conversely, negative perceptions of group work were typically linked to poor communication and mismatched expectations/workloads:

*Most of the assignment fell to me as some of the members of my group were incompetent.... [P]oor communication affected our group's ability to function effectively. Also some of the members in my team also never took any initiative. I had to tell them directly to do each bit of work which was really time consuming.*

*One guy did everything for one particular part without letting us in, so we did not know what's going on with that part, didn't end up well.*

*People didn't really respond to what I say – actually, not doing much actual work in the assignment is not as bad as ignoring my ideas. I like to bounce ideas off others as I work – but in my second group, few replied to my ideas.*

This demonstrates the utmost importance of communication in group work, and the value of instructors assisting groups to communicate well.

#### **(v) Influence of individual functioning in the group**

Significant correlations existed between the roles reported to be undertaken within a group. Frequency of being the group facilitator (“RoleFac”), timekeeper (“RoleTime”), recorder of decisions (“RoleRec”) and devil’s advocate (“RoleDA”) were all positively correlated. The highest correlation was between “RoleTime” and “RoleRec” (0.54), whilst the lowest correlation was between “RoleTime” and “RoleDA” (0.20).

This correlation could most clearly be seen in the influence of an individual reporting being the group facilitator compared to being timekeeper. Being group facilitator was a negative influence on the Enjoyment of group work (p-value<0.05), which is consistent with the quotes presented for the previous theme (iv). However, being a timekeeper was a positive influence, with statistical significance across all perception dimensions. Whilst facilitating and timekeeping largely offset each other in terms of influence for Assisted Learning and Enjoyment, this was not the case for Working Effectively. Being a facilitator had almost no influence on perceptions of a group working effectively; however, being a timekeeper did have significant positive influence on this dimension (p-value<0.05). This demonstrates the importance of project planning and time management to the successful functioning of a group.

Reported effort (“AssignEff”) and quality (“AssignQual”) of work undertaken relative to other group members were also correlated (0.75). However, perceptions of group work were driven by effort but not quality, with  $p\text{-value} < 0.01$  for Worked Effectively and Enjoyment and  $p\text{-value} < 0.05$  for Assisted Learning. This is consistent with the negative connotations of perceived workload imbalances described by Burdett and Hastie (2009), but also demonstrates that students were happy to work with group members contributing sufficient effort irrespective of the quality of their work. The importance of instructors creating structures that encourage group members to take on a variety of roles in their group is hence paramount.

#### **(vi) Influence of group work outcomes**

The assessment outcomes of group work, via either assignment mark (“AssignMark”) or exam mark (“ExamMark”), were found to be largely insignificant influences of group work perception across all dimensions, with assignment mark being a slightly significant predictor of perception of Working Effectively ( $p\text{-value} < 0.10$ ).

### **Conclusions and implications for practice**

This paper explored the impact of various exogenous and endogenous influences on student perceptions of group work across three different dimensions: effectiveness of how well the group worked together, assistance in learning from group work and enjoyment of group work. The results presented are based on student perceptions from a single course only, and hence may not be generalisable across other courses and disciplines. However, the issues discussed are not unique to actuarial science or business disciplines more generally, and hence the findings should be of interest across a variety of disciplines in higher education. A number of key implications for practice are elicited.

Looking at endogenous influences, the work affirms the utmost importance of appropriate instructional design of courses featuring group work, including relevant scaffolding of group-work tasks. In the course investigated in this paper the changes to the course to provide groups with a pro-forma set of group rules to follow had a significantly positive impact on student perceptions across all dimensions. However, the significantly poorer perceptions of effective working and enjoyment of group work in the second group are evidence of group-work fatigue and/or the greater difficulty in juggling group work when workloads in other courses increase in the second half of a teaching period. Instructors should be aware of these externalities when designing group-work activities.

Beyond this, the two other most important influences on perceptions of group work across dimensions were whether a student expects to enjoy group work and the amount of effort a student believes they put in relative to other group members. This points to the importance of instructors explaining the value of group work to students to their expectations of enjoyment of group work, and also the importance of designing assessments that minimise incentives for group members to be “free-riders” (which in itself can assist with expectations of enjoying group work).

Furthermore, the role a student takes in a group was found to have a significant impact on perceptions. Group facilitators were found to have significantly less enjoyment of group work than other group members, whilst, conversely, those who maintained a focus on timeliness enjoyed group work more and believed that their groups worked more effectively. Ensuring

groups are appropriately trained in time management and project planning is hence of benefit, along with encouraging students to take on a variety of roles in a project.

The information-sharing strategy used by a group had the most divergent impact on different perception dimensions. Whilst students in groups who met together in person more frequently reported improved perceptions of working effectively and enjoyment, students using other methods, such as social media, learning management systems and shared document servers, to share information more frequently reported improved perceptions of group work assisting their learning. In a broad sense, effective communication is clearly important for successful group work, and training students to be effective communicators in a group context is of benefit.

The impacts of exogenous influences were mixed and reflected the uncertainty in the literature in this area. The clearest evidence was that females believe that their groups work less effectively. As a result, the author of this paper adjusted the course in 2017 to ensure gender balance in groups (Takeda & Homberg 2014). This is a topic that would benefit from additional research to gain a better understanding of how to ensure that group work is beneficial for female students.

Additional future research could extend the exploratory nature of this paper with more-structured research designed to investigate such ideas as how student enjoyment of group work can be fostered and how course design can empower female students in group work.

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