

# Gender in student online discussions

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In a large online course, students were divided into 18 asynchronous online discussion groups with different gender mixes. The number and cognitive content of student messages were analysed. Females wrote more messages than males with no difference in the cognitive quality of message content. In mixed groups, females wrote fewer messages than in all-female groups but males wrote more messages than in all-male groups. Students' characteristics and views were described by 19 variables. There were significant gender differences in 11. In multiple regression, the variables most positively related to the number of messages written per student were: a preference for discussions being online; and a high course grade. These partly explained why females wrote more messages.

## Introduction

A one-semester course for social science and humanities students about the Internet and its social effects was taught annually from 1995/96 to 1999/00 to between 300 and 400 first-year undergraduates at Keele University, UK. The course was designed on constructivist educational principles, and encouraged independent student learning with discussion (Bostock, 1997). It was taught largely online, using the web as a flexible medium for providing course resources and support for activities. Student discussions using asynchronous text messages took place in virtual spaces over several weeks. Little tutor moderation was possible due to limited staff time. In 1998/99 there were 18 discussion groups of about 20 students. In previous years, online discussions had varied in the amount and quality of messages. To try to understand what made some discussion groups more successful, the transcripts of these online text discussions were analysed along with data about individual students, including their age, gender, experience, and views on issues related to information technology (IT).

## Course design

Many authors have discussed constructivism as a basis for curriculum design. Grabinger and Dunlap (1993) reviewed the literature and summarized it as five principles, summarized below. Lebow (1993), Jonassen *et al.* (1993) and Simons (1993) came to similar conclusions.

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1. Provide authentic assessment, with realistic tasks that need a deep understanding of the subject. Assessment is the major motivation for students. The learning outcomes to be assessed must be clear to everyone at the start, and the assessment must require students to demonstrate them.
2. Encourage student responsibility for learning. If students are to become autonomous, life-long learners they need to practise having responsibility for their own learning, including having some control of content, pace and tasks, and space to use initiative.
3. Provide learning activities that require students to use skills and knowledge in making a knowledge product. This might be a text, or the solution to a problem.
4. Provide an authentic context for learning. Learning should be anchored to real world events, problems and issues, rather than in a thin 'academic' abstraction of the real world.
5. Encourage co-operative support. Collaboration and debate deepen understanding.

Debate clarifies and elaborates concepts and identifies misconceptions, by requiring learners to defend their own views and accommodate those of others. Collaborative working pools good ideas to synthesize better ones.

The main feature of the course supporting co-operation was the online discussion groups, but their use was consistent with the other principles.

Keele University has an interdisciplinary degree structure where humanities and social science students do two natural science courses. In 1998/99 most of them chose this course, The Internet, of 12 taught weeks with a four-week break at Easter. Passing the course was a graduation requirement. Most of the 363 students were 18 or 19 years old and only 8% were 21 years or older.

The aims of the course were to give an understanding of the concepts, procedures and issues involved in using the Internet and online environments effectively for study and work. The learning outcomes were that students would be able to use the Internet to find, access and evaluate resources relevant to any particular subject; to participate appropriately in online discussion environments; and to discuss the impact of electronic networking on business, education, gender, and the nature of work. They were a mixture of technical skills, evaluation skills, and an engagement with social issues.

Students accessed the online course in two-hour sessions each week in a computer laboratory where postgraduate assistants helped individuals with technical skills. Alternatively, some students worked from home or from the library. Weekly sessions in a lecture theatre were used to show educational videos about Internet applications. Contact between individual students and the tutor (S.J.B.) was usually by e-mail, while face-to-face contact was possible at the videos and in practical sessions.

The course web site provided a collection of notes on course topics; instructions for practical tasks; summaries of, and questions about, the videos; the assessment requirements; course administration information; and a page of links to relevant resources on the World Wide Web. No paper materials were provided and none were required of students for assessment. The only aspect not on the web were the videos, which were available in the library.

Course assessment had two elements. The course grade was given for a final report describing the search for, and evaluation of, web resources on a topic individually agreed with the tutor by e-mail. Students submitted their report electronically. Secondly, evidence of completion of 10

practical tasks had to be submitted by e-mail or through web forms. The tasks included creating a personal web page, comparing search engines, and using synchronous text 'chat'. The task that is the subject of this paper was to demonstrate participation in their online discussion group. Specifically, they were to provide evidence of having written a number of messages including one message with significant content. The online discussion software (Basic Support for Cooperative Work, BSCW) provided an electronic transcript of all messages with date stamps.

Web forms were used to collect information and course evaluations from students. Many aspects of the course were popular but the views of students were varied. Table 1 summarizes the post-coded answers to the open questions on an evaluation form that were provided by at least 10 students.

Many students said they liked learning to use the global Internet, creating a web page, and synchronous chat across the network. Opinion was divided about the online discussion spaces. Dislike of the discussion spaces was mostly because of the delays they experienced when registering with the BSCW system due to technical problems. Nonetheless, making online discussions work well had been a problem in previous years (Clark, 2001; Bostock, 1998). Different group sizes have been tried and in 1998/99 groups of 20 were planned. There was a great deal of variation between individuals and between groups in the amount of discussion and this paper looks at one source of that variation, gender.

### Online discussions

Eighteen private discussion spaces were created for groups of about 20 students plus the tutor, within the BSCW web discussion system (<http://bscw.gmd.de/>; see Figures 1 and 2). The main practical difficulty was the registration of students with the system, which could be slow and produce errors. Once registered, students experienced few technical difficulties; the response time was generally acceptable. The discussion spaces were used from week 5 to the final week 12 of the course, to discuss the issue of the Internet in education. Some starter questions on the subject were provided on the course web site.

Students were told by e-mail how to find their discussion space. There was a Welcome message from the tutor waiting for them and they responded to it by introducing themselves

Table 1. Student evaluations

	Number of comments
Worst aspects of the course	
Summarizing the online tutorial	40
Using discussion spaces	27
Creating a web page	18
Best aspects of the course	
Searching and evaluating web sites	67
Creating a web page	49
Real-time chat	29
Using discussion spaces	17



Figure 1. A BSCW discussion as seen by the tutor, showing some message headers

to the group. The only other tutor message was added after several weeks, asking for the URL (web address) of a useful resource. Each week, each student was to ask a question, answer a question, or comment on an answer. A final task was to submit by e-mail a summary of their contributions to discussion (message headers only) plus one substantial message they had written.

### Gender and IT

Gender is an issue for IT (Grundy, 1996). Fewer girls and women study or have jobs in engineering; in schools and homes boys can dominate computer use, often for playing games; and females are typically less confident about using technology and have less experience with it (Bostock *et al.*, 1987; Rosen *et al.*, 1987; Perry & Grebber, 1990; Brosnan & Davison, 1994; Hatton, 1995; Ford & Miller, 1996; Blum, 1999). However, females are generally thought to be more 'chatty' and collaborative and the Internet supports such communication; females may be better at online discussion (Ory *et al.*, 1997; King, 2000; Herring, 2000).

To investigate the effects of gender, and the interactions between genders, the gender composition of online groups was manipulated, but students were not told. Groups 1–7 were wholly female; groups 8–13 were 50% female, 50% male; and groups 14–18 were wholly male. The tutor determined the group membership arbitrarily from a register, firstly, to achieve the gender



Figure 2. A BSCW message

mix and, secondly, to take students for each online group from all 13 practical sessions, to minimize their face-to-face contact.

#### *Analysis of discussion transcripts*

There were 1386 messages in total but, after disregarding the replies to the tutor's Welcome and URL messages, and any duplicate messages sent in error, 1015 messages were used in the analysis.

Discussions of content analysis often refer to the classification proposed by Henri (1992), which described five dimensions of message content:

- Participative, the number of messages or statements.
- Social, where statements are not related to formal subject matter, but are introductions, personal support, etc.
- Interactive, where statements have explicit references to other messages.
- Cognitive, where statements exhibit knowledge and skills related to the learning process.
- Metacognitive, where statements relate to general skills and show awareness and self-regulation of learning.

This is a good starting point for selecting the features of messages relevant in a particular context. The participative element was included as counts of messages of different types. The

social dimension was not analysed here—there was plenty of online socializing but these discussions had a specific educational purpose. (The social dimension was not used by Henri either; 1992, p. 134) The interactive dimension to messages was not used because this was partly determined by the task design: students were asked to respond to each others' questions so many explicit references to other messages would be expected.

Metacognitive processing is the demonstration of skills such as evaluation, planning, regulation and self-awareness. In fact, there was little or no evidence of metacognitive processing in these discussions so the messages were classified only for the cognitive dimension; this was the dimension of most interest in a context where students were to demonstrate appropriate participation in a discussion about a specific topic. Henri (1992, p. 130) characterized the cognitive dimension as a range between 'surface' to 'in-depth' cognitive processing. Henri suggested that 'despite its limitations, the analysis offers valuable information which can help educators give their learners appropriate cognitive support'. He did not provide descriptors of a scale of cognitive depth, so one was developed as a scale of 1 to 5 (surface to in-depth). Naturally, messages with more cognitive depth tended to be longer, and the typical length is also indicated in Table 2.

The authors of messages were identifiable by their Keele computer usernames so they could be matched with the data from the questionnaires, which always asked for the username but guaranteed anonymous use of the data.

### *Student characteristics*

Students completed three questionnaires, on weeks 2, 4 and 12, as web forms. The data collected generated 19 variables describing individual students. Some variables were the aggregates of data from several questions.

Student characteristics and experience was described by, for example, gender, age, experience with IT, online experience, final report percentage mark (assessed anonymously by S.J.B.), and whether they knew the others in their online group. Student views were solicited, for example, on their using IT, submitting work electronically, using online discussions, on their confidence about the role of computers in society, and their approaches to studying the course (using Meaning/Reproducing approaches to learning; Richardson, 1990).

Table 2. Classification of messages

Type	Typical length (lines)	Characteristics
1	1–2	Either with no academic content or simple, short open-ended questions, as prompted by the task instructions.
2	2–3	Simple statements of fact or opinion, or a question to start a discussion.
3	3–6	Some academic content relevant to the topic being discussed. Acknowledged personal opinion, or argument based on fact.
4	5–9	Clarification and elaboration, supported argument and inference. Speculation.
5	9–16	Substantial argument based on quotations or claimed facts. Development of new questions from facts. Clarification of issues. Attempts to summarize and make balanced judgements.

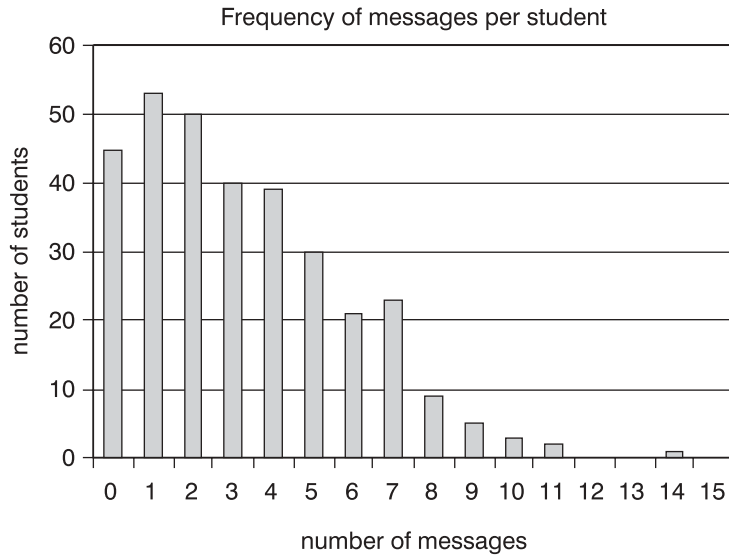


Figure 3. Messages per student

## Results

The number of messages per student is positively skewed (Figure 3). This is typical of online discussions; many students send a few messages, and fewer send more messages. It means that these data are not normally distributed so they were analysed with non-parametric methods.

Using the scale of cognitive processing described above, the commonest messages were of intermediate quality (Figure 4). The pattern is similar for all gender groups although single-gender groups had a slightly higher percentage of messages with higher cognitive value than mixed groups. So later analysis used the total number of messages, rather than the cognitive content of the messages.

All-female groups had significantly more messages per student than male groups ( $p < .05$ ). The average for mixed-gender groups was intermediate but, mostly, not because of mere 'statistical mixing' of the genders: the messages per female (FX) dropped while the messages per male (MX) increased over the number in single-gender groups (Figure 5). On average, 81% of the difference between the mixed-gender groups and the single-gender groups was due to the changes in the average number of messages of each gender in the mixed groups. Only 19% was due to statistical mixing of two genders that continued to write the same number of messages they did in single-gender groups. The online presence of females somehow encouraged messages from males while the presence of males deterred writing in females. Some students probably guessed the gender of other students from the login names they had chosen within BSCW, or from their message content, but most students in discussion groups did not meet face-to-face, and there was no gender difference in this.

Mixed groups were more variable than single-gender groups (but not significantly so). Especially variable were the number of messages contributed by males in mixed groups (see the

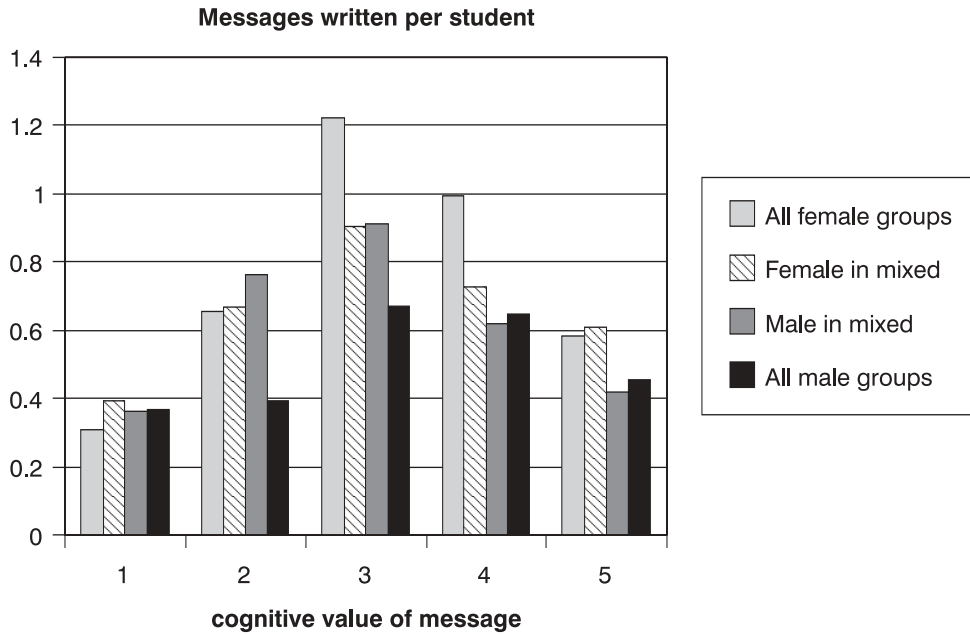


Figure 4. Message quality

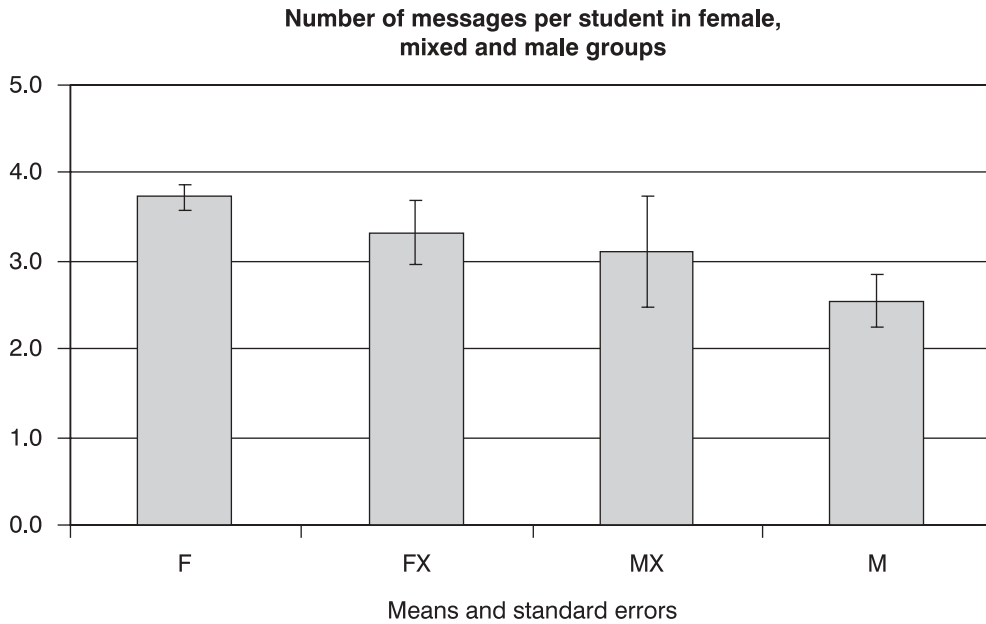


Figure 5. Mean number of messages per student in different types of group. F, females in single-gender groups; FX, females in mixed-gender groups; MX, males in mixed-gender groups; M, males in single-gender groups.

standard errors in Figure 5), which were significantly more variable than the female groups ( $p < .05$  in an  $F_{\max}$  test). In both the male groups and the mixed groups, the group with most messages per student had twice the number of messages per student than the group with the least messages. The female groups were more similar to each other and the ratio of the longest to the shortest discussion was only 1.3.

Of the 19 student variables, males and females were significantly different in 11 (see Table 3). More females were less confident of using computer applications, were less positive about using computers, thought they would use them less in their courses, and preferred paper to online information. More females thought that they would find the course difficult but they had higher average final report marks. (The much higher practical mark for females included the online discussion task and so is not discussed further.) More females preferred online discussion to face-to-face discussion, and they rated BSCW as a discussion environment more highly. They were equally confident to the males in the use of BSCW discussion software, even though they had lower confidence with IT applications generally.

Other variables that might have related to online discussion activity had no significant difference between genders: age, experience of IT applications, preference for working in groups, knowing members of online discussion groups face-to-face, and hours worked in part-time jobs. There is a small difference in the Approach to Study (Richardson, 1990) and it is in an unexpected direction: females had a significantly higher score on the Reproducing scale (rote learning).

To relate the gender differences described above to the differences in message-writing, a multiple regression was performed of the 19 variables (plus gender) on message number per student. 'Regression with optimal scaling' (CATREG in SPSS version 10) was used as the variables were of different data types (continuous, ordinal, category). By progressively eliminating the least significant variables, four variables were found that together provided the most significant multiple regression ( $p < .001$ ) on the total number of messages. Gender was not a significant variable. In order of decreasing importance (and numbered as in Table 4) they were:

- a. preference for discussions online rather than face-to-face discussions (8);
- b. the percentage grade for the final course report (19);
- c. age (4, a negative factor);
- d. a positive attitude to using computers (10).

The multiple regression equation is very significant statistically but it only explains 22% of the variation in message number per student (Table 4). Pratt's Relative Importance shows how important is each variable. A stated preference for online rather than face-to-face discussion (variable 8) and the grade given for the course report (19) are the most important. Both have significantly higher scores for females (Table 3). The main result from this analysis is that females wrote more messages on average than did males because (1) more of them had stated they preferred online discussions to face-to-face discussions and (2) they produced better final reports, presumably because they were more able, or conscientious, or engaged with the course.

Age (variable 4) is negatively related to message number: the few students older than 21 years wrote fewer messages. There is a small difference between the average ages of the genders that might have contributed to the overall gender difference in messages written but the effect, if any, would have been small.

Table 3. Gender differences

Variable and any difference	Female median (mean)	Male median (mean)	Range of values	<i>p</i> of null hypothesis
1 More women prefer to submit work on paper than online	2	1	0–2	.040*
2 Women had a little less experience of IT applications, but non-significant	3	4	0–6	.054
3 More women prefer information on paper rather than web pages	1 (1.16)	1 (0.08)	0–2	.003**
4 Age in years	19 (19.59)	19 (19.71)	17–48	.070
5 There was no difference in the proportions who had used Usenet (for online discussion)	0	0	0–2	.72
6 More women thought the course was going to be difficult	0 (0.57)	0 (0.91)	0–2	.003**
7 More women preferred discussion online than in face-to-face groups	1	0	0–2	.001**
8 More women rate BSCW highly as an environment for discussion	3	2	0–4	.017*
9 There is no difference in the number of their discussion group they know face to face	0	0	0–4	.19
10 Women had a lower score on ‘positive attitude to using computers’	26	29	0–42	.012*
11 Women rate themselves less confident in using IT applications	6	7	0–10	.002**
12 There is no difference in the confidence of using BSCW	1	1	0–2	.28
13 Women thought they would use a computer less in their main courses	2	3	0–4	.03*
14 There was no difference in the hours worked in part-time jobs	0	0	0–27	.37
15 There was no difference in the Meaning orientation in approach to study (Richardson, 1990)	2.62	2.56	0–4	.67
16 There was a higher mean score on Reproducing orientation in approach to study (Richardson, 1990)	2.85	2.62	0–4	.002**
17 There was no difference in preference for working in groups	1	1	0–2	.53
18 The mean mark for practical work was higher for women ( <i>t</i> -test)	(40.4)	(37.5)	0–70	.000***
19 The mean mark for the end of course report was higher for women ( <i>t</i> -test)	(47.0)	(40.4)	0–85	.036*

Significance tests were Mann–Whitney tests for medians of two unpaired groups, except for *t*-tests on means in variables 19 and 20. \**p* < .05; \*\**p* < .01; \*\*\**p* < .001.

Sample size was 321 or less, depending on the questionnaire response rate.

Table 4. Multiple regression

	Standardized beta coefficient	<i>F</i>	Pratt's Relative Importance
a. Preference for BSCW	0.308	17.78	0.428
b. Report mark	0.241	10.88	0.263
c. Age	-0.193	6.87	0.181
d. Positive to IT	0.160	4.73	0.129
			1.000
Overall, adjusted $r^2$	.22		
Overall <i>F</i>		11.15	
Degrees of freedom	4, 144	$p < .001$	

In the penultimate week of the course a questionnaire included questions, based on Wishart (1997), asking students for their views on whether they found computers interesting or frightening, whether they should be used more widely, and whether they could get out of control. Seven questions with a Likert scale of seven points produced a scale of 0 to 42 described as 'positive attitude to using computers' (variable 10). Although significant, this is the least important variable in the regression and it is working against the overall gender difference: women made slightly fewer positive statements about using computers. This would tend to reduce the average number of messages written by women compared to men, but it is overridden by the larger effects of variables 8 and 19.

## Conclusions

Messages were classified on a scale of cognitive processing depth and a range of message types were found in all groups. Although mixed-gender groups had a somewhat lower average score, the variability between groups meant that there was no significant difference in the average quality of messages on the cognitive processing scale. For this reason, the number of messages was used as the measure of success of a discussion.

The number of messages written in online discussions by individual students was related weakly to many independent variables in the multiple regression. The two most important were: a stated preference to liking online discussions more than face-to-face ones; and a better course report mark. These were two of the many variables for which a significant difference was found between females and males. This is a partial explanation of the higher number of messages written by females. Females tended to prefer online discussions and performed better than males in other work, and these were the best predictors of message number. Other gender differences did not contribute to explaining message-writing, or even worked in the opposite direction. For example, females said they were less confident in using computers in general, and had a greater preference for paper over wholly online work.

There was also an effect of online gender interactions on the number of messages being written. The fact that mixed-gender groups had an average number of messages per student that was intermediate between those of females groups and of male groups was largely not due to a simple statistical mixing. The average number of messages written by females declined in groups

containing males, while the males tended to write more messages. Something about the number or content of messages from each gender affected the number of messages written by the other. It was not due to a difference in the cognitive quality of the messages, as this was similar for different gender groups. Examination of the transcripts does not reveal the reason; they do not show why further messages were not written.

The impulse for the study was to improve the effectiveness of online discussion. Are there consequences of these results for the course design? In this course at least, older students may have benefited from some targeted support. Also, we should try to alleviate anxiety about IT generally, as it was associated with reduced message-writing. As for the gender mix of discussion groups, we have a dilemma: there seems to be a trade-off between the advantage for males being in mixed-gender groups and the disadvantage for females.

The fact that, even online, females were inhibited by the presence of males is consistent with their preference for online over face-to-face discussion, which is the best predictor of higher online activity. We may speculate that in face-to-face discussion the effect might have been greater. The CSALT report on networked learning in Higher Education (2001) reviewed the design of group composition for collaborative online learning, including gender effects. Males can dominate online discussions as they can face-to-face discussions. However, they have not done that in the mixed groups in this study, at least in terms of messages written. On the other hand, the CSALT review of mixed-ability groups suggests that while low-ability students may benefit, high-ability students may not suffer. In the specific context of the number of messages written in this study, the higher-ability females did suffer a reduction of activity in mixed groups, while the lower-ability males benefit as might be expected.

There are arguments both for and against imposing heterogeneity on student work groups, in gender and other factors. If we are primarily concerned with allowing each to maximize their performance we would at least allow females the option of all-female groups. On the other hand, if we were more concerned with developing social or team skills, with possible advantages for employability, we could defend the use of deliberately mixed-gender groups. By the time this analysis was complete, the course was no longer being offered, so this difficult decision was avoided.

### Notes on contributors

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