

Collaborative problem solving in student learning

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Abstract

It had been apparent to teaching staff of our department for some time that the tutorial system in place for large introductory-level classes was not functioning optimally. Tutorials were re-designed around problem solving and applications of theory, undertaken by students in small groups. Assessment was also re-designed in keeping with the changed course emphasis. In evaluating the success or otherwise of this change in the approach to the conduct of tutorials, we used both quantitative and qualitative techniques. The qualitative responses of both students and tutors were very positive. Quantitative evidence of improved outcomes is harder to adduce, but we did find sufficient evidence to encourage us to extend the changes to other large classes.

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Changing the tutorial experience in introductory economics

1. Introduction

Becker and Watts (2001) have observed, from their extensive longitudinal survey on teaching methods in undergraduate economics courses, that the preferred method is still “chalk and talk”. They argue that this undesirable situation persists because university reward structures focus on research at the expense of teaching and because staff and students focus on end-of-semester student evaluations and assessment, respectively, at the expense of student learning. It had been apparent to teaching staff of our department for some time that the tutorial system in place for large introductory (100-level) classes was not functioning optimally. The system, simply described, was that students came to tutorials once a week and were supposed to have attempted certain pre-assigned questions, but often had not made any serious effort to do so. They were unwilling, for the most part, to engage in a discussion about the questions and preferred to wait to be given the “right” answers by their tutor. To a greater or lesser extent, each individual tutor obliged, sometimes by copying answers provided by the course coordinator onto the whiteboard, thus approximating “chalk and talk”. This system had existed unchanged for many years. No doubt a knowledgeable, enthusiastic and experienced tutor could provoke some engagement of the students with the subject matter but, in our view, this was the exception. In the absence of any sanction or reward surrounding attendance, many students simply did not attend tutorials.

Apart from the obvious fact that such a tutorial experience was dull, to continue with this system seemed to be a waste of learning opportunities. Consequently, we designed a course of action in one of our large first-year courses to turn the focus of the tutorial experience

onto student participation. This involved the use of a model of collaborative problem solving, which is described in section 2 below. Our particular implementation of this model of learning is outlined in section 3, while section 4 contains a summary of our efforts to evaluate this change in our tutorial system both qualitatively and quantitatively. We conclude that the change has been received, by the majority of students, in a positive fashion. The teaching staff involved have all been sufficiently positive that the method is currently being used in two more large classes.

2. Background

In large first year 100-level classes, resource constraints often mean that lectures comprise 200 or more students. Such numbers make student interaction difficult to encourage and monitor. Tutorials, on the other hand, are limited to 20-25 students and as a consequence are more amenable to small group problem solving sessions. However, student attendance at these tutorials has been poor in the past with a potentially valuable contact hour being wasted.

The standard method of tutorial delivery has been to give entire sets of questions at the beginning of the semester (or lecture block) which students were then required to attempt before their allotted tutorial time. In the tutorial session itself, students were rarely willing to offer answers, possibly concerned about social sanctions from others within the group. The session often became tutor-centred with the tutor delivering a “mini lecture” to a dwindling group of students. If there were no compulsion to attend, many would not do so.

It is clear that the traditional approach we have taken to tutorials has focussed simply on the transmission of knowledge. Trigwell *et al* (1999) identify that many studies have established a consistent relationship between such surface approaches to learning and lower quality learning outcomes. They also note that those teachers who have the student as the focus of their activities, by encouraging self-directed learning, are more likely to encourage a deeper approach to learning. Jenkins (1992) argues that, even in the large class lecture situation, “by breaking up the lecture into short segments, many of which are devoted to students in small groups working at tasks devised by the lecturer, students in large classes can work actively and feel personally involved.” The small group tutorial session is arguably a much easier place to implement such a strategy.

Meade (1997) identifies the most significant change facing universities is to expand the traditional teacher-centred method of teaching to include a greater range of student-centred learning methods including the use of personal self instruction, case studies, peer assessment, and group work. To begin to meet this challenge and in an effort to improve the value of tutorials for students, we decided to introduce a new style of tutorials. Our approach was based on the sort of practices described in, for example, Johnston *et al* (2000), in the context of intermediate macroeconomics, and Jackson and Prosser (1989), in a first- year political science class

3. Design and implementation

The main goals of our project were: to improve student attendance at and participation in tutorials in economics; to enliven the tutorial experience for students in an effort to stimulate

their interest in the subject; and to facilitate deeper learning and a closer association between theory and contemporary economic issues and problems.

Tutorials were designed around problem solving and applications of theory, undertaken by students in groups of four to five. Tutors were instructed to encourage participation and discussion and to keep groups productively focussed on the tasks in hand. At the very beginning of each tutorial, small groups were formed and some tasks that students had not seen before were distributed. These tasks typically involved questions using newspaper articles for critical analysis and evaluation with students asked to identify theory which could be applied to the articles and to evaluate the likely outcome in terms of the theory, or data sets for analysis with students asked to use economic theory to interpret empirical data. A sample of the type of material used is contained in appendix 1.

Typical sources for stimulus material included *The Economist*, local newspapers and the business press. Questions surrounding this material involved the application of economics covered in lectures and assigned reading from the course textbook to the issues raised. The types of questions varied from lower level skills such as comprehension to higher level skills such as the insightful interpretation of current events and data in the light of appropriate economic theory. The intention of this approach was to increase the skills of analysis and synthesis, as well as to stimulate greater participation in tutorials and more academic application by providing students with experience in solving economic problems in a co-operative small group setting. For the sake of brevity we refer to the approach hereafter as collaborative problem solving (CPS).

In assessing the outcome of such a trial, the question of setting up a control group naturally arises. The most obvious approach may seem to be to randomly assign half of the class to the CPS style of tutorial and half to a “traditional” style of tutorial. This raises at least three difficulties. First, the issue of contamination across the two groups of students. It seems likely that students assigned to the two different “treatments” are likely to be in a position to share teaching materials. In our experience, students not only share materials within a class but across year groupings from students who have previously taken a course. Second, and much more serious from our perspective, is the ethical issue. As examiners (as well as teachers) we are required not only to be fair, but also to be seen to be fair. If, as we genuinely believed, such a change in approach would improve outcomes for students, on what basis could we prevent access to the new approach for half of our students? Third, if we specifically were targeting the skills of analysis and synthesis in terms of application of economic theory to everyday situations, we would want to change our style of examination to reflect this, further disadvantaging the “traditionally” tutored students. To have students subjected to both styles of tutorial sit the same examination would lead to a lack of congruence between the course content and the method of assessment and add to the ethical difficulties by examining all students, in part, in a way in which only some of them have been trained.

An alternative way of dealing with the control group problem would be to attempt a between-year comparison, but this raises difficulties of comparability in assessment. According to Boud (1995:48), “Good assessment ... both closely reflects desired learning outcomes and ... the process of assessment has a directly beneficial influence on the learning process.” Assessment is the most significant prompt for learning but it can encourage passive, reproductive and altogether undesirable forms of learning. In

introducing CPS-based tutorials, we wanted to develop in our students the capacity to apply their theoretical knowledge of economics in novel contexts. Part of the examination process had to reflect this objective and the practice that students attending tutorials had experienced. Accordingly, we introduced a section on the exam (worth 30% of the marks) which contained a number of questions very similar in format to those of the tutorials, but using stimulus material previously unseen by members of the class. In terms of assessing the success of the CPS approach, we would put more store in student performance on this type of exercise than in the more usual multiple choice or short answer questions. Multiple choice and short answer types of question remained part of the assessment, partly for ease of marking, but partly in the recognition that the CPS-type exercises represent higher level skills that may be more difficult for all students to attain. The nature of the assessment changes therefore precludes the use of a previous year's class as a control group.

The perceived ethical dilemma in handling the issue of a control group was practically resolved by our interpretation of the University of Otago's policy on ethical practices in research and teaching involving human participants (University of Otago 1999). Our research did not require formal approval of the University's Ethics Committee since it consisted only of a questionnaire that students completed voluntarily. In our view, however, any different treatment of students in the same course sitting the same exam would breach at least two of the principles governing ethical approval, namely that participants must give "informed consent which is given free from any form of coercion" and the "risk of harm to participants" must be minimised.

In the face of these difficulties, we chose to trial the CPS tutorial method in first year macroeconomics, ECON102 (macro), and use as our control group the most similar group

of students we could find, namely those in ECON101, introduction to microeconomics (micro). Micro is traditionally taught in semester one at Otago, with macro in semester 2. We planned a switch to the new method of tutorial teaching in semester 2 of 2000. Micro attracts more enrolments, mainly because it is compulsory for majoring students not only in economics, but also in accounting, finance and tourism. Macro is compulsory only for economics majors. Nevertheless, there is a large overlap in the two enrolments and both classes are dominated by students in their first year of university study.

We are conscious that we have thus introduced a potential source of “contamination” of our results. It could be argued that the two subjects are not at all the same or that one is inherently more interesting and/or harder than the other. In the face of ethical difficulties, we have no better alternative to offer and, as well as avoiding the ethical dilemma, we also avoid any potential cross-contamination from differently treated groups of students studying the same subject.

4. Evaluation

In evaluating the success or otherwise of this change in the approach to the conduct of tutorials we used both quantitative and qualitative techniques. A survey of student views was designed that included both standard types of rating questions and open-ended solicitation of general comments. Qualitative information was also gathered in two meetings with class representatives who provided feedback in a small group discussion setting with the co-ordinator of undergraduate studies and head of department. Weekly meetings between course lecturers and the tutors provided qualitative information on the tutors’ perceptions of the changes. We were also concerned with outcomes, so that we

have tried to link performance on the final examinations with tutorial involvement. We outline the findings from each of these evaluation methods below under the sub-headings qualitative findings, survey results and examination outcomes.

Qualitative findings

At the end of the student survey form, the following open-ended question was included: “Are there any other comments you would like to add about the micro (macro) economics course?” When the data were captured each comment was typed out by a secretary processing the forms to avoid the possibility of identification by teaching staff of any individual student.

The CPS type of approach to tutorials was generally well received by students, to judge from their comments. Positive comments about student centred tutorial work outweighed negative views by a considerable margin. Typical of these comments were:

“Tutorials are much better than 101, because they are not boring.”

“I really prefer discussing with people when in tutorials. Helps me a lot.”

“I have enjoyed macroeconomics much more than microeconomics. I have especially found the tutorials more interesting/enjoyable and more informative. I even prepare for them.”

“The tuts are heaps better – more student involvement than 101. I’ve been to all tuts in 102 compared to about four in 101.”

A few students did seem to resent not being “taught” in tutorials. The following comment exemplifies the attitudes of this type of student: “Would be good if tutorials were more

about the tutor teaching, rather than a lot of umming and arghing in groups. Tutorials would help me more if they were similar to lectures.” While this sort of comment could be construed as at least positive with respect to the lecture setting, it is our view that it misses the point about learning, at least active learning, which requires the individual reconstruction of knowledge and skills or ‘learning-by doing’ (Martin and Balla 1991). The fact that “Many students prefer teaching that enables them to listen passively ... and that prepares them well for tests” does not alter our belief that “better retention, thinking, and motivational effects” occur “when students are more actively involved in talking, writing and doing” (McKeachie 1997: 1219).

The overwhelmingly positive views about CPS-based tutorials also came through in the meetings with class representatives². The class reps made efforts to elicit comments from other students, both in writing and informally, prior to meetings with the co-ordinator of undergraduate studies and head of department. It was clear from discussion in these meetings that students saw little value in attending tutorials in micro, apart from those who enjoyed the close-to-individualised assistance available to them as a consequence of the very poor attendance rates. The feedback about macro tutorials was much more positive.

Right from the first week the macro tutors met, their view of the improvement in the nature of tutorials was clear. They no longer felt pressured to repeat a “mini lecture” nor to be the focus of student attention. Given that the majority of our tutors are senior students with little teaching experience, they saw these as substantial benefits. The tutors were

² The Students’ Association of the University of Otago operates a system of “class reps”. Each class is asked to elect class reps to represent them in dealings with the teaching staff. In practice, elections are rarely required and the two or three people per class willing to act in this capacity are appointed by common assent of the class. In this sense, they are representative often of a more confident and vocal minority.

much more comfortable in the role of facilitating small group discussion. They also felt that student attendance and participation levels were markedly improved.

Survey results

Appendix 2 reproduces the questions from the survey form used in macro tutorials. The form for micro was the same apart from the omission of question 9 and the substitution of “micro” for “macro” throughout. The design of the form followed the format of student and course evaluation questionnaires from the Higher Education Development Centre (HEDC) of the University of Otago since students are familiar with this type of survey.

Students were required to circle a number on a rating scale from 1 to 5 corresponding to statements ranging from “strongly agree” to “strongly disagree”. Such a 1-5 rating scale cannot be interpreted in any way as cardinal, so that the calculation and comparisons of mean scores by paired t-tests would not be valid, but would confuse cardinal and ordinal measures (Katzner 1998: 4-5). The correct statistical procedure is to use either a Chi-squared test with one degree of freedom or the equivalent Z test (Berenson and Levine 1999: 653-654).

Table 1 presents the proportions of each category of response for each question for the micro and macro samples, respectively as well as the z-statistics appropriate for comparing the proportions of each category between the micro and macro samples, except in the case of question 9 which appears only on the macro survey. A positive value of z indicates proportionately more respondents in micro choosing that category for that question, while a negative z indicates fewer respondents in micro choosing that category. The z values can

be judged to be statistically significant or otherwise against the values in a standard normal table.

Because of the possibility that anything from zero to five response categories for any given question might or might not be statistically significantly different, the interpretation of such results is very messy. To provide a clearer picture of our results we followed the HEDC's procedure for summarising teaching evaluation questionnaires and combined the categories "agree" and "strongly agree", deleted the "don't know" and also combined "disagree" and "strongly disagree." Since we now just have a two-way classification of responses to the survey questions, we test only whether the proportions in the combined "agree" categories are different, since the z-statistic for the combined "don't agree" category is the negative of the z-statistic for the combined "agree" category. Table 2 presents these condensed results.

Questions 1 and 2 were intended to address student attitudes to economics. The results from question 1 show that students find macro difficult (and this result is statistically significant). Moreover, the proportion expressing this view is over double that thinking micro difficult³. There is no significant difference in the proportions of students finding macro more satisfying to study than micro.

Questions 3 and 4 relate to the level of self-perceived student effort. There is some evidence in favour of macro students reading more but very strong evidence of more general preparation for macro tutorials. This sort of preparation could refer either to the

³ There are probably two main factors contributing to this result. The first is that the questions, being of a problem-solving nature in macro, are in fact more difficult than the often-routine exercises in the micro course. The second important factor is that the final-year high school course in New Zealand in economics is heavily

attempting of the questions that were to be dealt with briefly at the beginning of the session or to completing relevant textbook or other reading.

Questions 5 and 6 relate to aspects of tutor performance. The students picked no significant difference in competence of their tutors in micro and macro with respect to ability to explain. We would perhaps have been surprised had they done so, since the tutors for macro were almost a subset of those for micro (due to the smaller number of enrolments in macro) and were selected more on the basis of availability than anything else. Students did feel that the macro tutors tried harder to make the subject interesting. Since the tutors were essentially the same group, this interest factor probably stems from the changed format of tutorials and the nature of the material, although we are not yet ready to dismiss the effect of tutor and/or student enthusiasm for a novel venture, something like a Hawthorne effect (Franke and Kaul 1978).

Questions 7 and 8 were chosen to elicit information about student attitudes to co-operative work. In spite of the change to CPS tutorials, no statistically significant change in student attitudes to co-operative learning was noted. It seems that one hour per week of working in a more co-operative mode has not transferred to any generally perceived change in approach to study.

Question 9, which appears only on the macro survey, was a much less subtle attempt to make an inter-course comparison. It asked directly for reaction to the statement: "I rate the tutorials in macroeconomics more highly than those in microeconomics." About 70% of students who responded and had taken both courses either agreed or strongly agreed with

weighted towards microeconomics (Learning Media 1990). Many of the students have studied economics at school level.

the statement. (See table 1). Another 19% were neutral, leaving about 11% disagreeing or strongly disagreeing, although less than 2% were in the “strongly disagree” category compared to nearly 30% in the “strongly agree” category. Taking this rather less subtle questioning as valid and combining it with the other evidence we have suggests that, from a student attitude perspective, the change was worthwhile. Deleting the “don’t knows” and combining the top two and bottom two categories as before results in 86% rating macro tutorials more highly than micro tutorials.

Examination outcomes

We have exam results and tutor ratings for everyone in the class who sat the final examination, so we turn to these to try again to establish whether participation in this type of tutorial improves results. To measure each student’s degree of participation we had tutor’s rate student performance on a 0 to 5 scale⁴. These ratings could provide up to 5% of a student’s final course grade and thus affect the outcome by marking an individual’s result upwards by at most a grade⁵. The ratings were based to a great degree on the tutor’s perceptions of student effort rather than ability. In essence what we were trying to measure was the extent to which each student had actively participated in the CPS system.

⁴ The students and tutors were both informed of the following rating scale at the beginning of the course:

<i>Participation in group work</i>	<i>marks</i>
rarely or never participates:	0
sometimes participates:	1
often participates:	2
often participates and is usually thoroughly prepared:	3
often participates insightfully:	4
usually participates insightfully:	5

⁵ For example, if other assessment resulted in a student achieving a B, a tutor assessment of 5 would see this grade altered to a B+, while a 0 rating would leave the B unchanged.

Table 3 shows comparisons of two groups of students classified by tutor ratings in three different ways. First, the high-rating group contains all those scoring more than 3; second, the high-rating group contains only those scoring 5; third, those scoring 5 are compared only against those scoring 4. No matter which of these definitions of high-rating we use the higher-rated group outperforms the lower-rated group on all types of exam question. The reported t-statistics are for testing the null hypothesis that the mean scores on a particular part of the examination of the higher-rated group and the lower-rated groups do not differ.

Recall that the intention of question 9 was to look for a definitely positive response to the change in style of tutorials. In table 4 we classify students by their response to question 9. Those who were positive about the change in style of tutorial scored more highly on all types of question, but only statistically significantly so on the problem solving questions. It was precisely this type of exam question that was most closely modelled on the tutorial tasks and that examined the highest order skills.

In summary, there is a strong positive relationship between tutor ratings of students' participation in CPS tutorials and results on all parts of the examination, while students who preferred the new style of tutorial performed significantly better than those who did not only on that part of the examination most closely related to the CPS tutorial questions.

5. Conclusion

In the face of the ethical difficulties surrounding research into changes in teaching method, we are unable to adduce strong experimental evidence for a change in student performance resulting from the changes we made to the tutorial style in our introductory macro course. However, it is clear that a considerable attitudinal shift has been initiated. On the whole, students are more satisfied with the new approach, as are tutors and other teaching staff. Given the impossibility of comparing performances on differently designed courses over time, we must place a good deal of reliance on qualitative feedback. This feedback has been sufficiently positive for the changes to be extended to two more large class papers in our department. The challenge of assessing these ongoing changes remains.

Appendix 1 Samples of tutorial tasks

Tutorial #8

Task #1

Read the extract "Fuelling inflation?" from *The Economist* of 11 March 2000 and answer the following questions.

- (a) "The surging oil price reflects both production cuts by OPEC and stronger-than-expected global demand..." Explain using supply and demand analysis.
- (b) "... Oil prices tripled ... and the world economy went into recession." Explain using AS/AD analysis.
- (c) Why are "the economic consequences of the jump in oil prices" expected to be "less severe now than they were in the 1970s"?
- (d) If you were a Central banker would you be convinced by the arguments in (c)? What action would you take in the face of rising oil prices?

Task #2

Read the extract "Japanese finance. Below zero." from *The Economist* of 14 November 1998 and answer the following questions.

- (a) When taxes are cut and government spending increases, why do "bond traders usually take fright" and what effect would you usually expect these policy changes to have on the private sector?
- (b) Why does a long bond yield of 0.81% suggest falling prices for a decade or so?
- (c) What does "Japan's current account surplus is growing larger" imply for the capital account and overseas investment into Japan?
- (d) Why do the Japanese need to "believe in inflation again" to help the economic recovery?

Tutorial #9

Task #1

Read the article “Job creation credited with drop in jobless” which is from page 3 of the *Otago Daily Times* of 4 August 2000, the day after the release of the June 2000 Household Labour Force Survey by Statistics New Zealand.

Read the article and try to answer the following questions.

- (1) Why does Mr Anderton see the HLFS as a "trifecta"?
- (2) Why does the ANZ Bank see the same result as "fundamentally weak"?
- (3) Who do you think is right and why?

Task #2

Consider the data in the following table and comment on the following statement:
“The table clearly shows that Pakeha men are discriminated against in the New Zealand labour market.”

Average usual hourly wages - males (1998)

<i>Qualification group</i>	<i>Pakeha</i>	<i>Maori</i>
1 no qualification	9.51	11.50
2 School certificate	10.23	11.38
3 Sixth form cert.	11.54	12.04
4 Higher school qual.	12.48	15.34
5 Other school qual.	8.50	12.84
6 Vocational or trade	12.08	12.82
7 Degree	17.34	18.32
8 Other post-school	13.81	14.35

Source: Income Survey (Statistics New Zealand 1998).

Appendix 2 Survey questions - macro

The response scale was as shown below.

For each question circle the number that best indicates your reaction.

strongly agree	agree	don't know/unsure	disagree	strongly disagree
1	2	3	4	5

The questions were:

1. Generally I find macroeconomics difficult to understand.
2. I get a lot of satisfaction from studying macroeconomics.
3. I generally do the set reading before the corresponding lectures and tutorials.
4. I usually prepare before coming to tutorials.
5. My tutor tries hard to make the subject interesting.
6. My tutor is good at explaining things.
7. When studying macroeconomics I prefer to work alone.
8. When studying macroeconomics I seek help from other students when I need it.

Please answer Question 9 only if you studied ECON 101 and ECON 102 this year.

9. I rate the tutorials in macroeconomics more highly than those in microeconomics.

Are there any other comments you would like to add about the macroeconomics course?

Table 1 Proportions responding in each category and z-statistics

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
micro									
<i>Strongly agree</i>	0.0253	0.0506	0.0127	0.0443	0.1266	0.1835	0.0728	0.1126	
<i>Agree</i>	0.1139	0.4873	0.2532	0.3608	0.6203	0.6266	0.2781	0.4503	
<i>Don't know</i>	0.1013	0.2468	0.1456	0.1203	0.1582	0.1392	0.2715	0.1722	
<i>Disagree</i>	0.6329	0.1962	0.4051	0.3291	0.0823	0.0506	0.3113	0.2384	
<i>Strongly disagree</i>	0.1266	0.0190	0.1835	0.1456	0.0127	0.0000	0.0662	0.0265	
macro									
<i>Strongly agree</i>	0.0193	0.0386	0.0388	0.1163	0.1313	0.1853	0.0954	0.1037	0.2978
<i>Agree</i>	0.3050	0.4942	0.2752	0.5620	0.6564	0.6448	0.2697	0.5145	0.3989
<i>Don't know</i>	0.1583	0.3012	0.1860	0.1357	0.1699	0.1236	0.2365	0.1411	0.1910
<i>Disagree</i>	0.4595	0.1660	0.3643	0.1628	0.0386	0.0425	0.3568	0.2033	0.0955
<i>Strongly disagree</i>	0.0579	0.0000	0.1357	0.0233	0.0039	0.0039	0.0415	0.0373	0.0169
z-stats									
<i>Strongly agree</i>	0.4098	0.5860	-1.5437	-2.5029	-0.1384	-0.0455	-0.7733	0.2756	
<i>Agree</i>	-4.4806	-0.1361	-0.4930	-3.9861	-0.7466	-0.3752	0.1825	-1.2372	
<i>Don't know</i>	-1.6448	-1.1978	-1.0650	-0.4538	-0.3107	0.4629	0.7790	0.8324	
<i>Disagree</i>	3.4409	0.7825	0.8306	3.9368	1.8950	0.3877	-0.9277	0.8205	
<i>Strongly disagree</i>	2.4532	2.2256	1.3138	4.7545	1.0312	-0.7820	1.0829	-0.5841	

Table 2 Condensed results from table 1

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
"agree" (micro)	0.1549	0.7143	0.3111	0.4604	0.8872	0.9412	0.4818	0.6800
"agree" (macro)	0.3853	0.7624	0.3857	0.7848	0.9488	0.9471	0.4783	0.7198
z	-4.6873	-0.9340	-1.4119	-6.3363	-2.1244	-0.2409	0.0591	-0.7705

Table 3 Mean scores by tutor rating

Exam section	Multi-choice out of 40		Problem solving out of 30		Short answer out of 30	
<i>Tutor rating</i>	>3	<=3	>3	<=3	>3	<=3
<i>mean</i>	25.33	21.33	17.19	14.25	17.33	13.37
<i>var</i>	29.77	23.97	19.48	20.99	21.22	24.99
<i>n</i>	320	118	320	118	320	118
<i>t</i>		7.34		6.02		7.51
<i>Tutor rating</i>	5	<5	5	<5	5	<5
<i>mean</i>	25.70	21.96	17.62	14.46	17.65	14.08
<i>var</i>	30.25	24.55	18.89	19.74	20.66	24.85
<i>n</i>	268	170	268	170	268	170
<i>t</i>		7.36		7.30		7.55
<i>Tutor rating</i>	5	4	5	4	5	4
<i>mean</i>	25.70	23.23	17.62	14.98	17.65	15.74
<i>var</i>	30.25	24.48	18.89	17.25	20.66	20.41
<i>n</i>	268	48	268	48	268	48
<i>t</i>		3.13		4.02		2.69

Table 4 Mean scores by responses on question 9

Exam section	Multi-choice out of 40		Problem solving out of 30		Short answer out of 30	
	agree	disagree	agree	disagree	agree	disagree
mean	25.65	25.43	17.78	15.78	17.63	17.54
var	29.49	29.55	18.24	23.07	18.47	25.75
n	196	53	196	53	196	53
t		0.26		2.74		0.12

In this case “disagree” includes “neutral”.

Question 9 was: I rate the tutorials in macroeconomics more highly than those in microeconomics.

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