

**Opportunities and New Directions 2013:**  
*Barriers and Breakthroughs*

**Team Projects in an Introductory Course in Statistics**

**Cyntha Struthers**

**Dept. of Mathematics, St. Jerome's University and**

**Dept. of Statistics and Actuarial Science,**

**University of Waterloo**

**and**

**Don McLeish**

**Department of Statistics and Actuarial Science,**

**University of Waterloo**

# STAT 231 – Course Description

**Empirical problem solving**, measurement systems, causal relationships, statistical models, estimation, confidence intervals, tests of significance.

STAT 231 is a core **required** mathematics course for students in the Mathematics Faculty.

The Department of Statistics and Actuarial Science draws its undergraduate Statistics **majors** from this course.

# STAT 231 Winter 2013

LEC 001	313 students	01:00-02:20TTh	M3 1006	McLeish, Donald
LEC 003	110 students	08:30-09:50TTh	MC 2065	McLeish, Donald
LEC 002	38 students	11:30-12:50TTh	STJ 3014	Struthers, Cynthia
TUT 101	38	04:30-05:20W	STJ 3014	Struthers, Cynthia

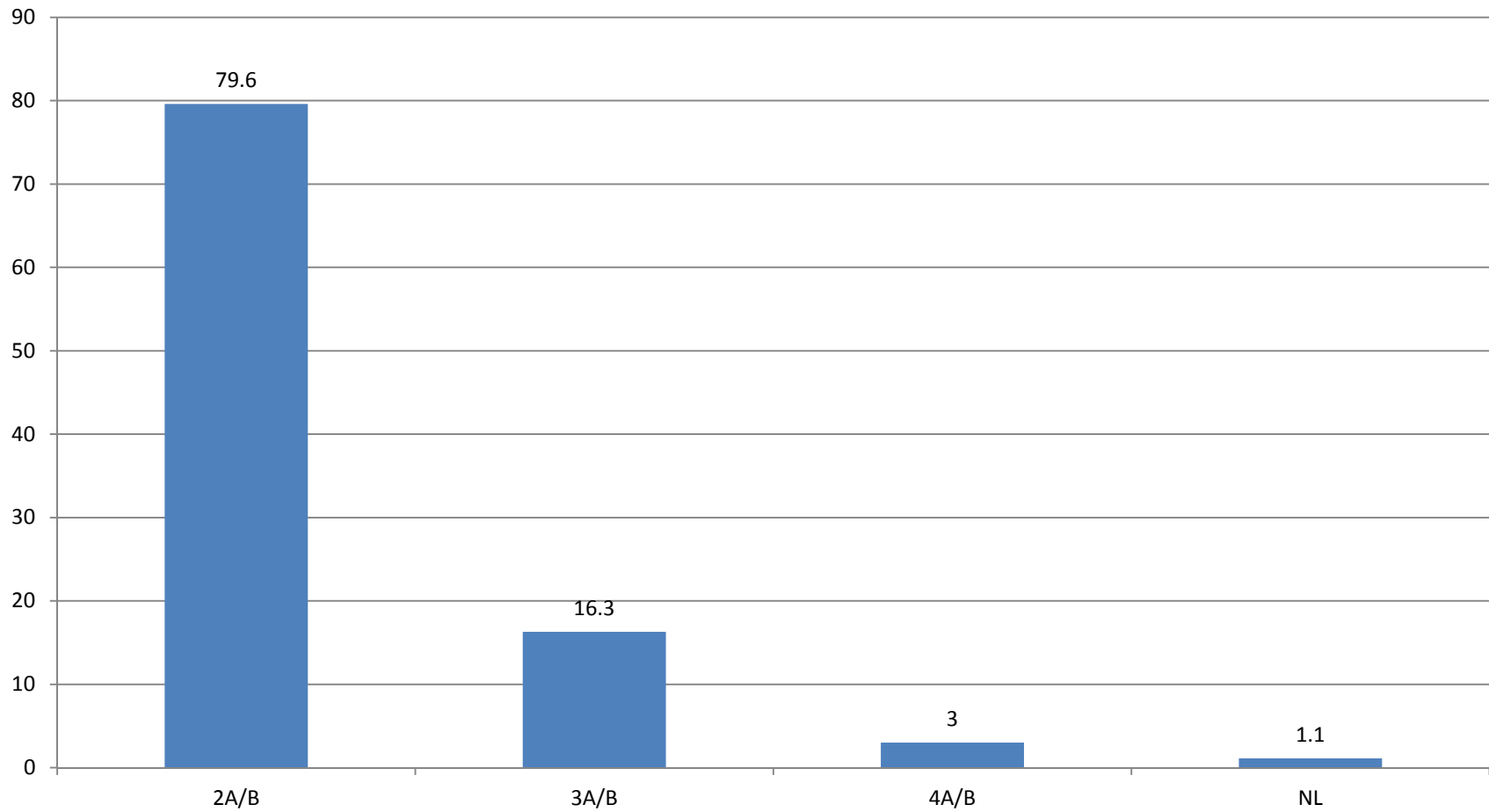
2 Instructors

461 Students

14.5 Teaching Assistants, 1 Head Teaching Assistant

The instructors used the same lecture slides. All sections had the same two midterm tests and final examination. Only section 002 had a tutorial hour.

# Students by Year



# Why Team Projects?

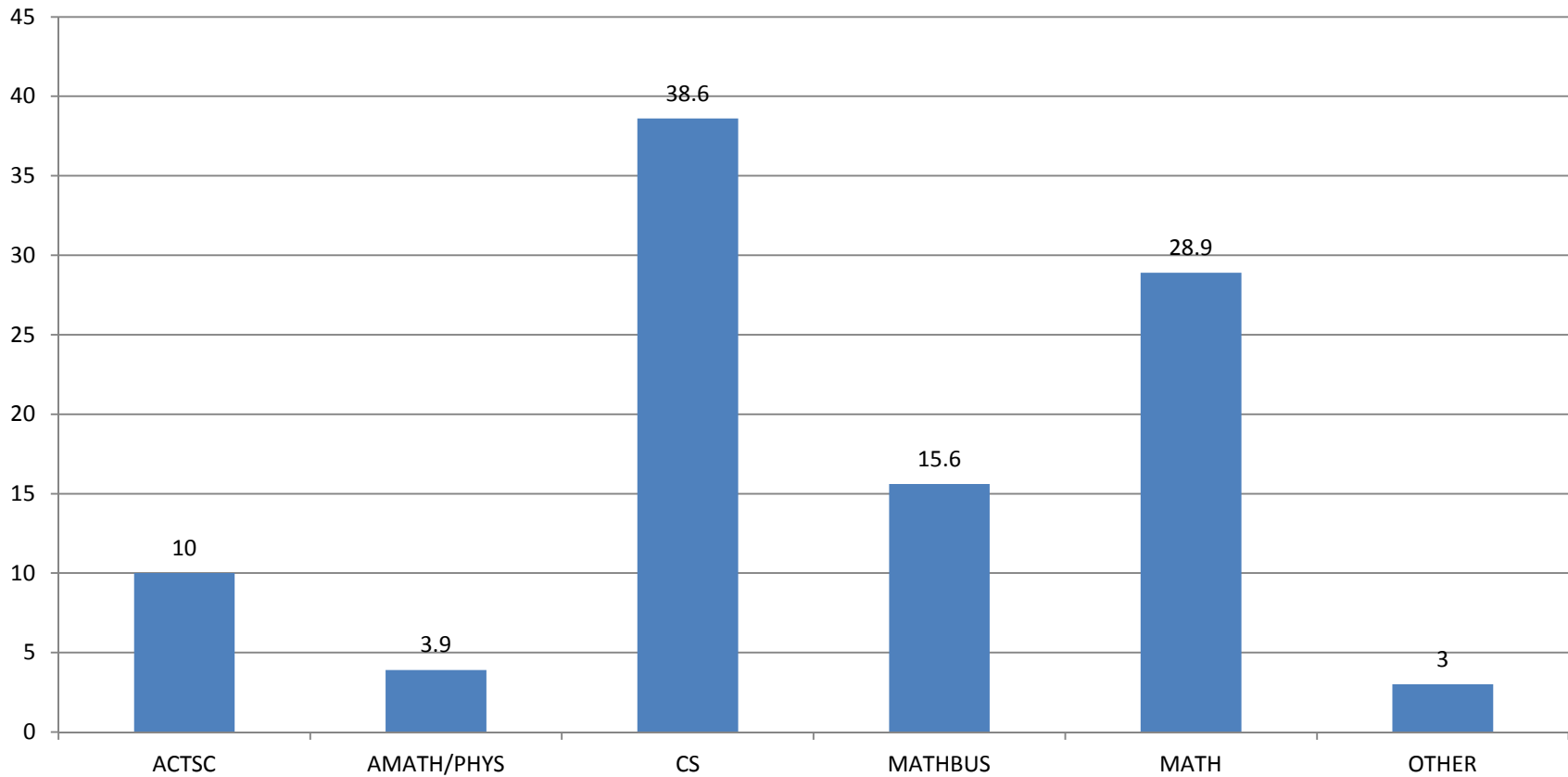
- Since statistics is the science of planning experiments, collecting data and drawing inferences, it seemed natural that an exercise in doing this should play an important part in this introductory course in statistics.
- We also hoped to develop the students' skills for teamwork and scientific communication, and to give them an opportunity for interaction with other students.

# Why Team Projects?

- Assignments are obsolete in terms of evaluating students. There is a great deal of plagiarizing which is difficult to monitor. You can now find services online that do assignments for payment. Dealing with cheaters is time-consuming and depressing for instructors.
- Students do assignments, the TA's grade them and the students never pick up the graded assignments. Students just look at posted solutions. We believe the marking of assignments for student assessment has become a waste of time.

The majority of the students have specialized interests in computer science, business or actuarial science.

**Students by Program**

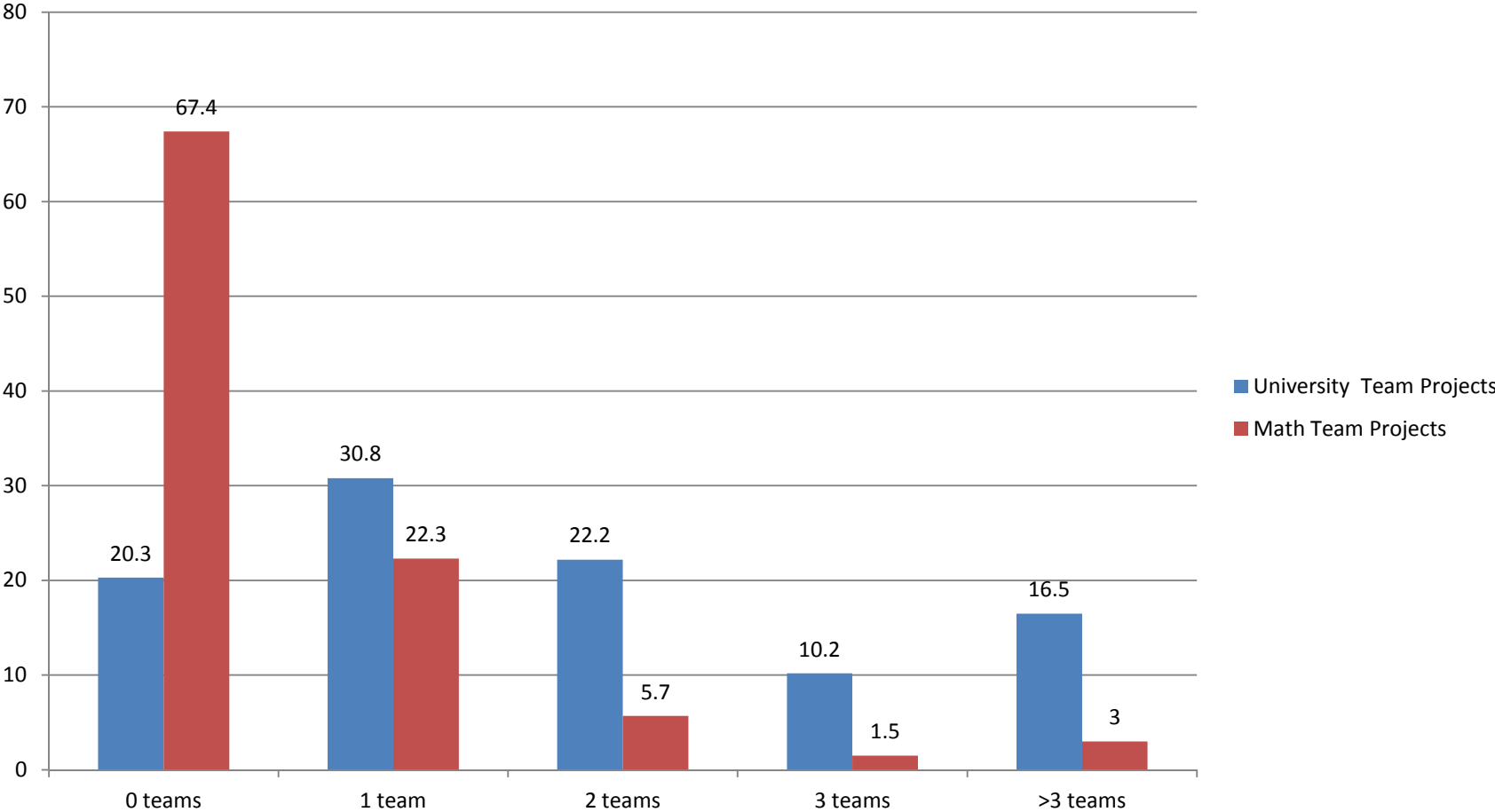


# How to select team members?

- We decided that teams should be created on the basis of their program. The teams were then expected to find or collect data relevant to their area of specialization.
- We believed that they would gain an appreciation of the breadth of applications of statistics and the difficulties in drawing inferences from data subject to variability.



# Previous Experience with University Team Projects



# Team Formation

- Teams of size 4 were created based on program obtained from QUEST.
- Team size was chosen based on the number of TA's assigned to the course and the fact that the amount of work required for the project could still easily be handled by a team of three if a student dropped the course or did not contribute to the project.

# Difficulties with Team Formation

- Teams were created manually in D2L in the second last week of December.
- On January 1<sup>st</sup>, 59 students who had not arranged their fees were “removed” from D2L which left many teams with only two members or three members. Teams were reassigned.
- As students arranged their fees they “appeared” in their originally assigned groups. Some teams now had six or seven team members. Students were reassigned again.
- Many teams no longer contained students only from the same program.

# Late Enrollment Problems

- January 14-18: First team meetings with the TA's.
- January 18: Last day to enroll.
- January 25: Due date of first part of the project.

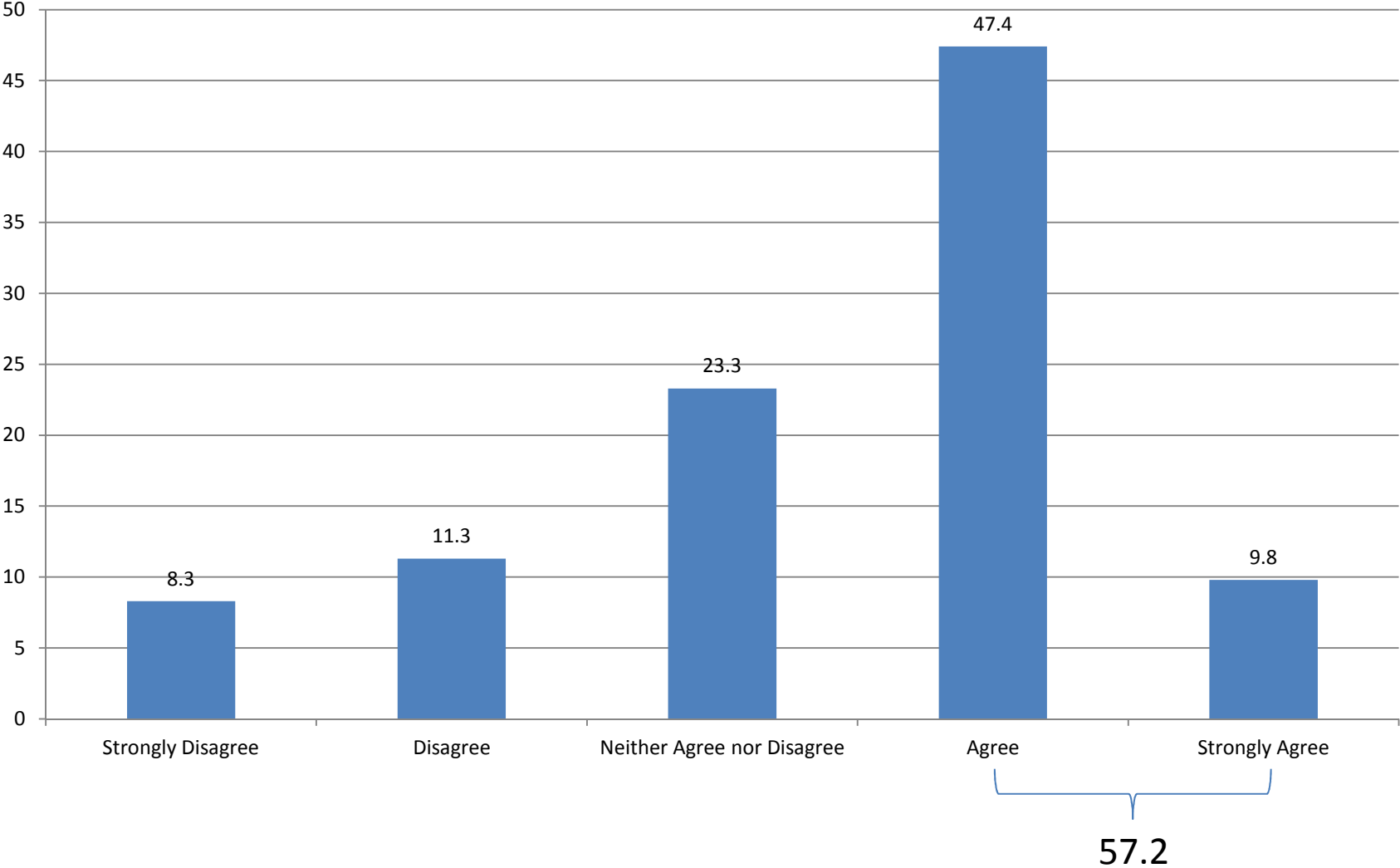
# Team Meetings

- There were 120 teams.
- Each TA was responsible for approximately 8 teams and met 4 times during the term with each team.
- The Head TA was responsible for scheduling the TA's and their teams. (This was difficult since most of the TA's were taking the same courses.)

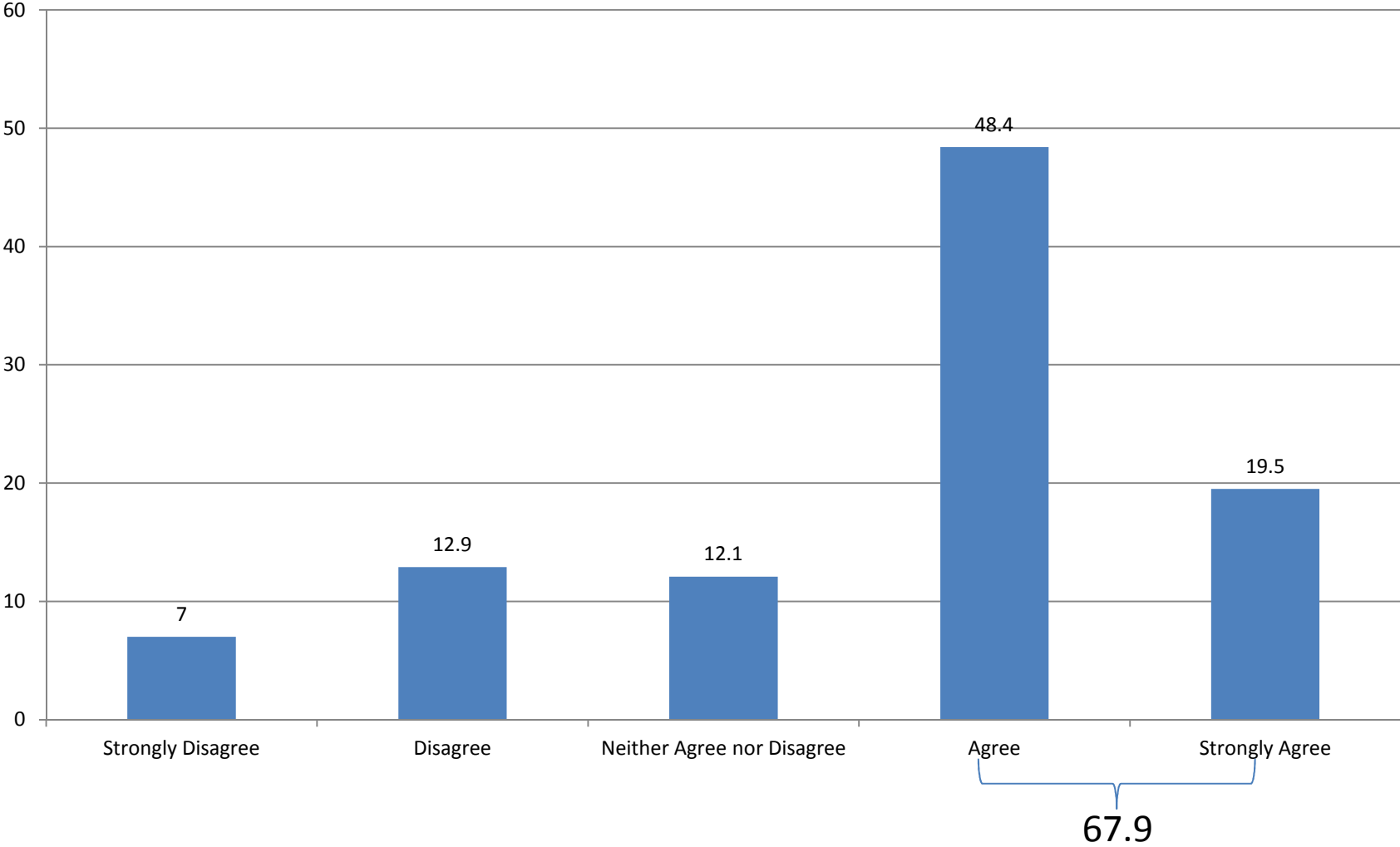
# Online Student Survey

- At the end of the term we conducted an online survey regarding the team project experience.
- The response rate was 57.1% (233/408) for sections 001&003. For section 002 the response rate was 89.2% (33/37). The overall response rate was 59.8% (266/445).
- There were no differences in responses between sections 001&003 and section 002.

# Team Projects give Experience Helpful for Future Careers

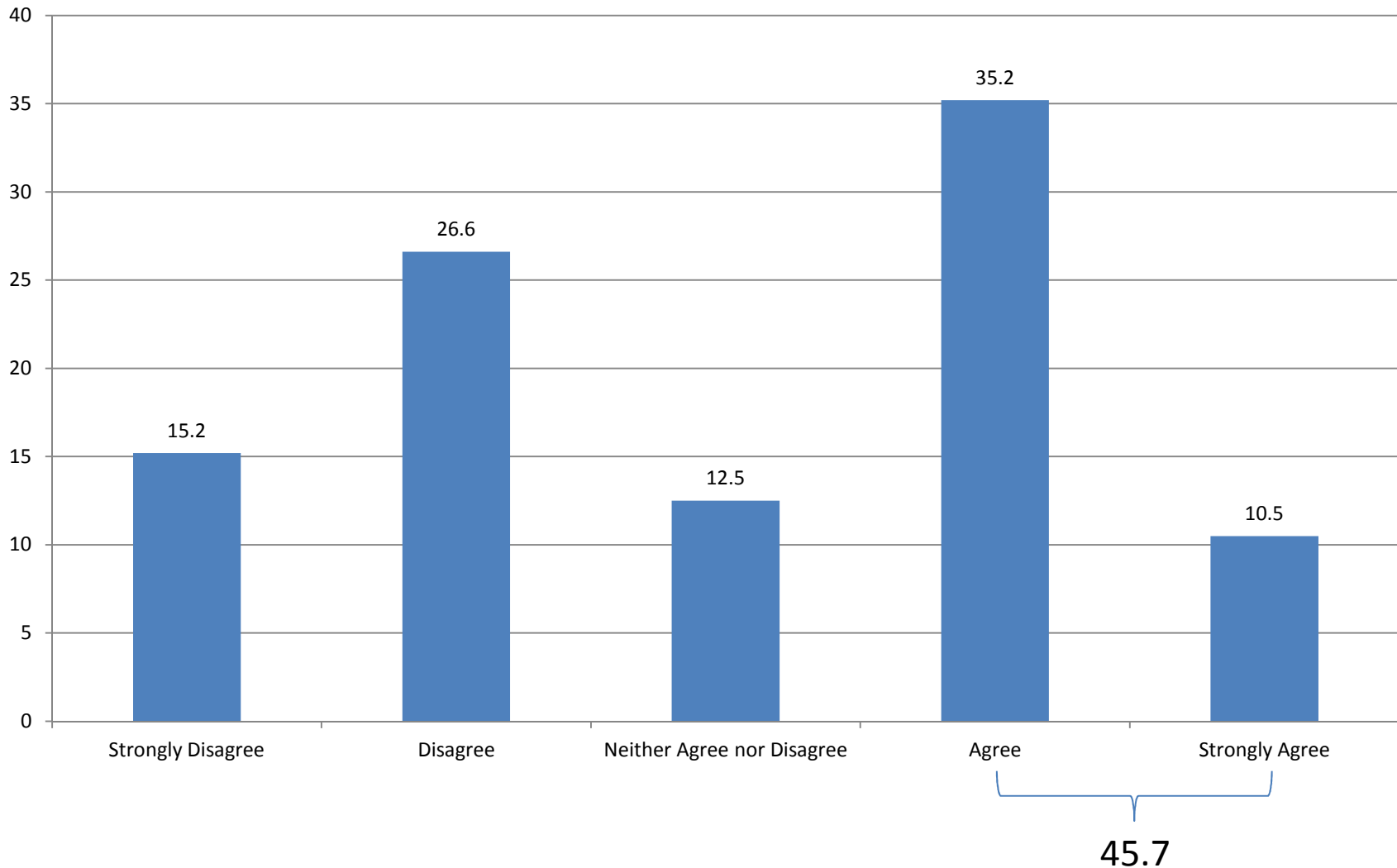


# Pleased with how team worked together

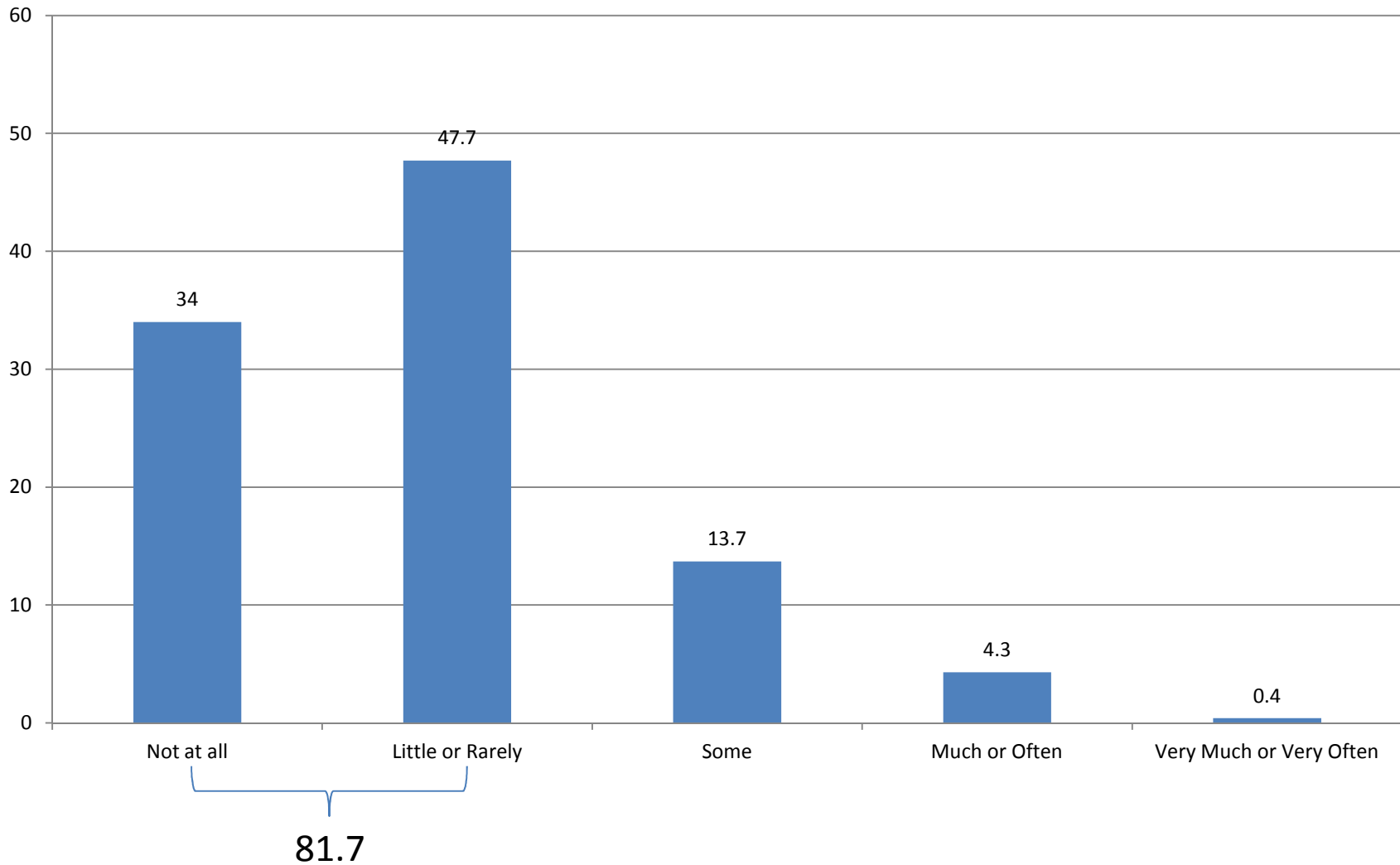




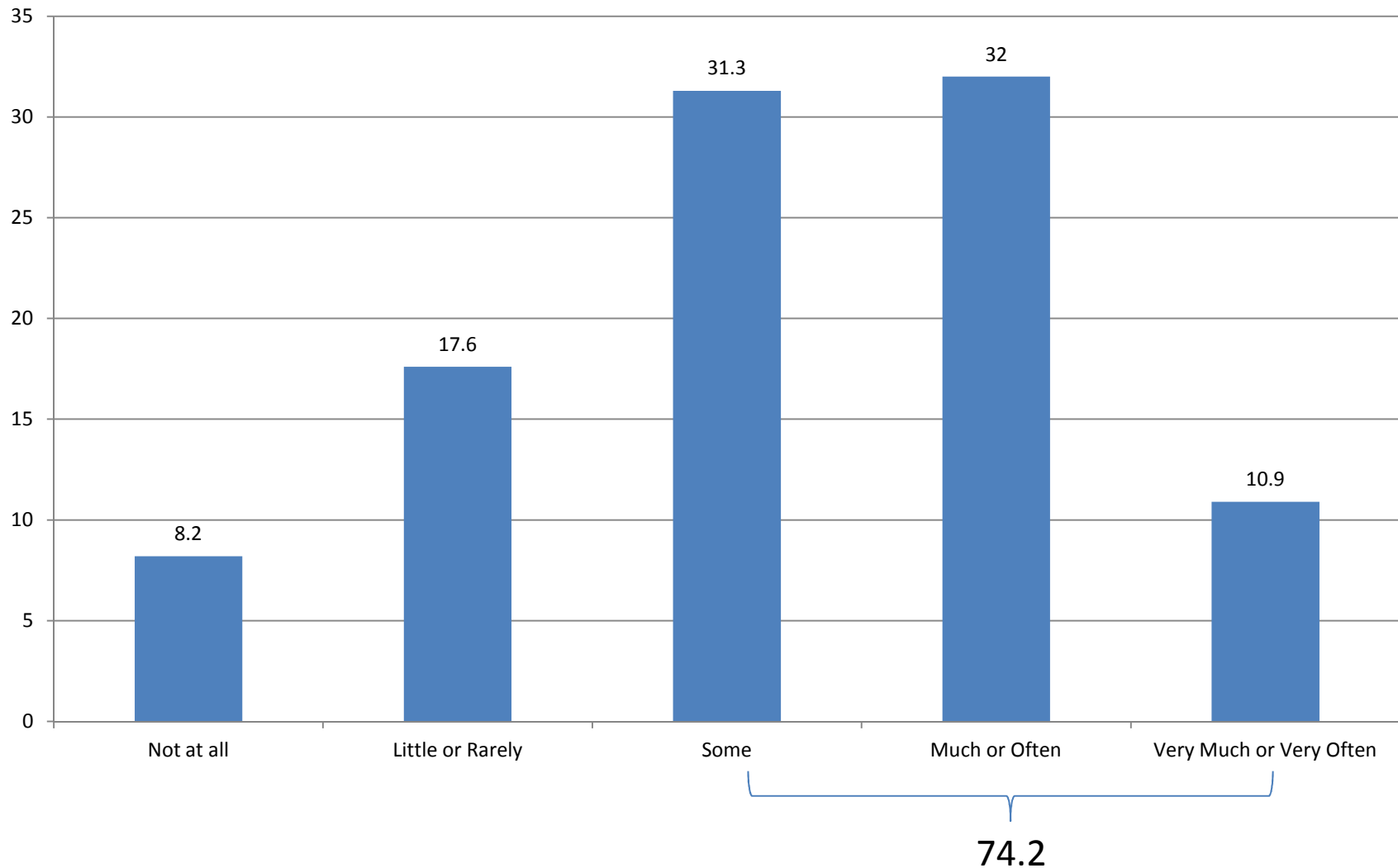
# Teammates contributed equally to team project



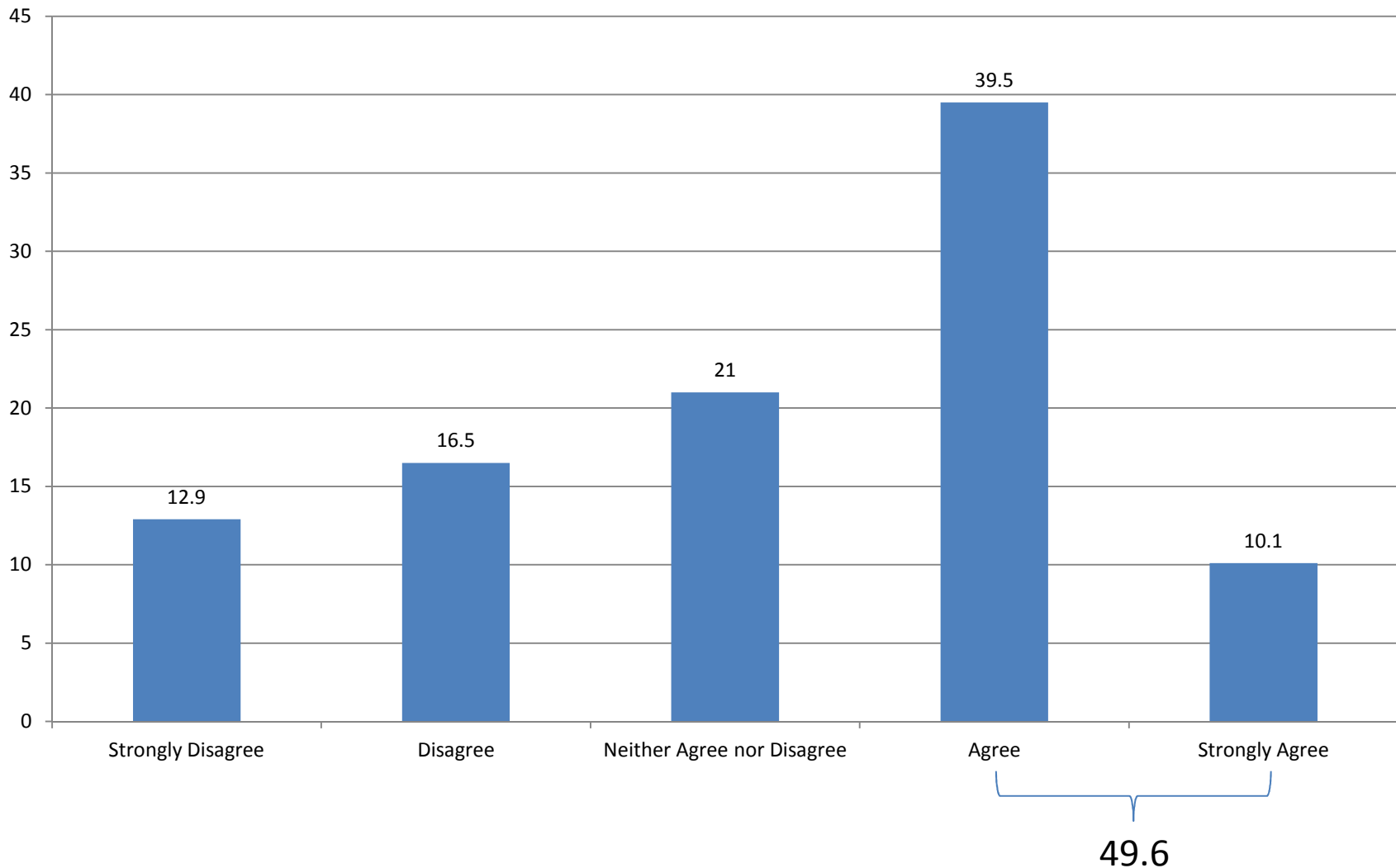
# Disagreements about who should do what



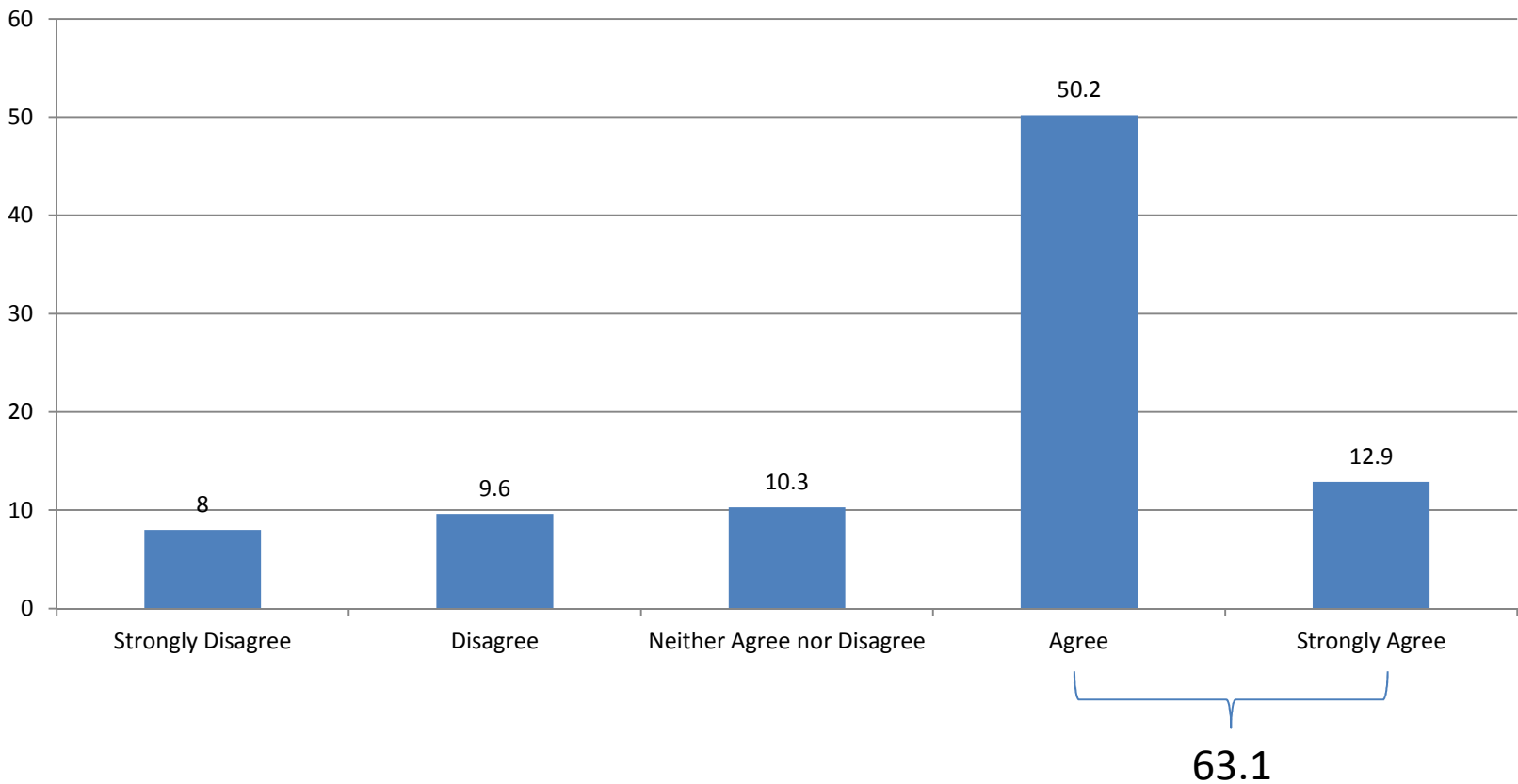
# Teammates encouraged other teammates



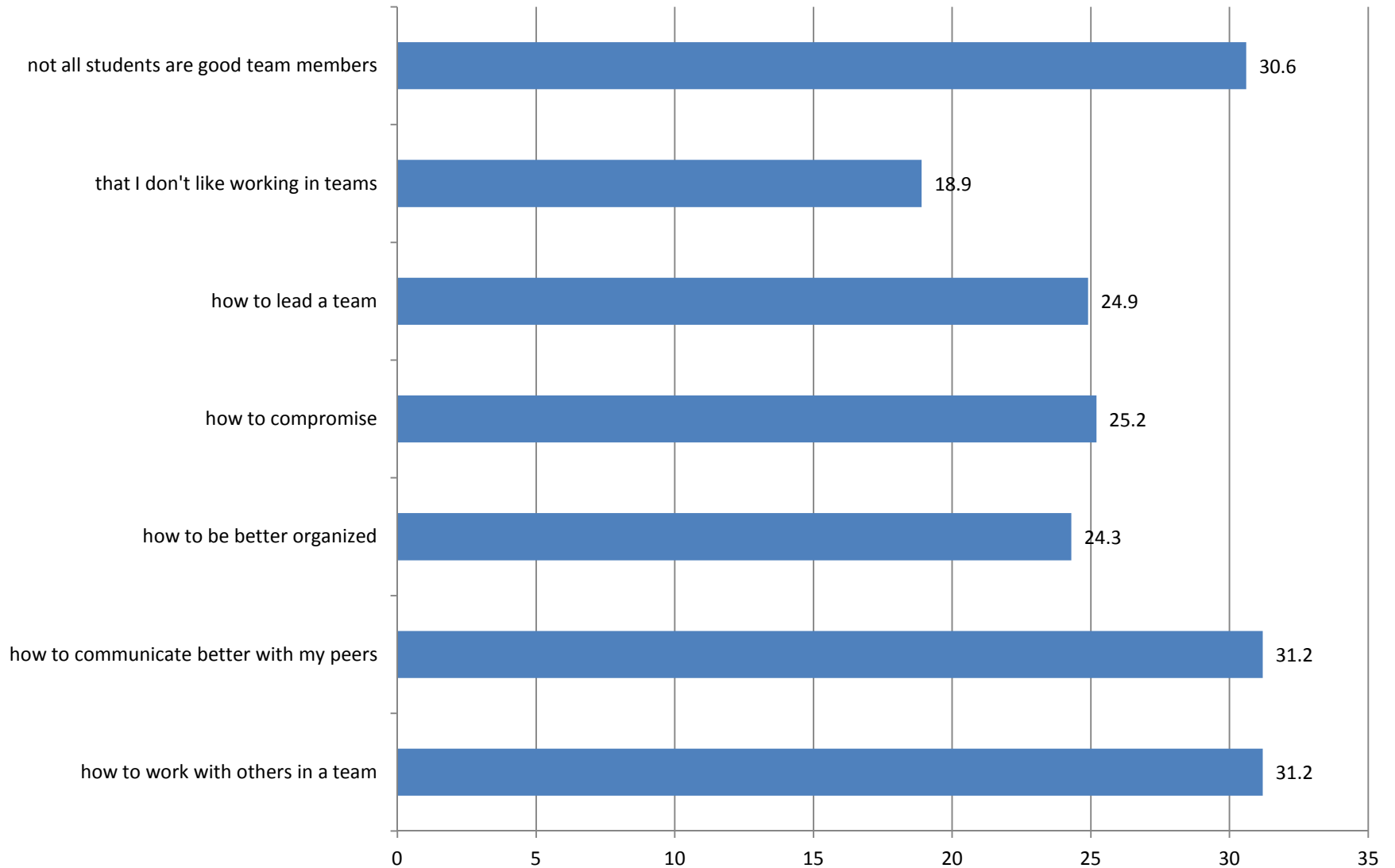
# Team project helped me to appreciate the real world applications of statistical reasoning



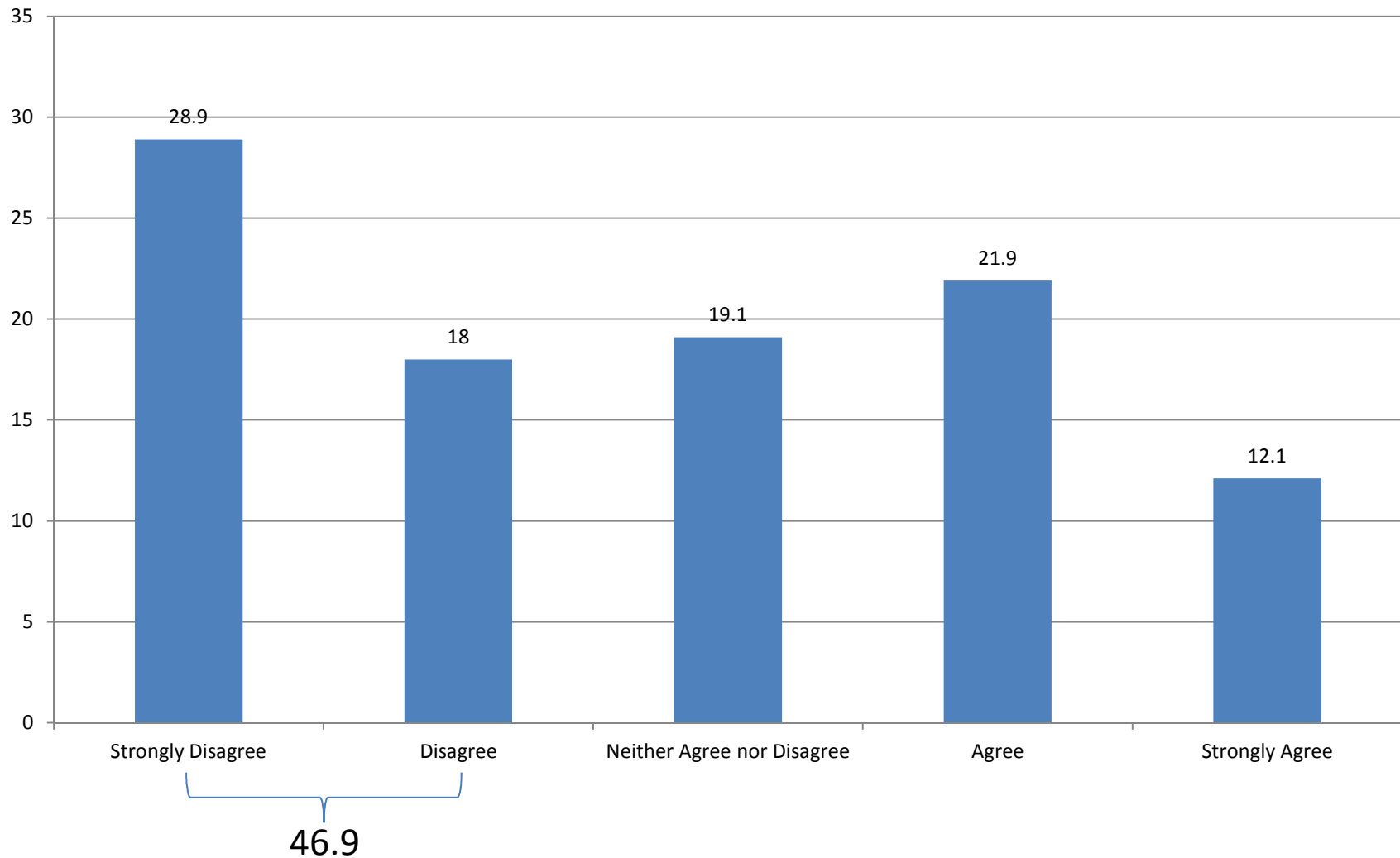
# Team project helped me to recognize difficulties in drawing conclusions from data subject to variability



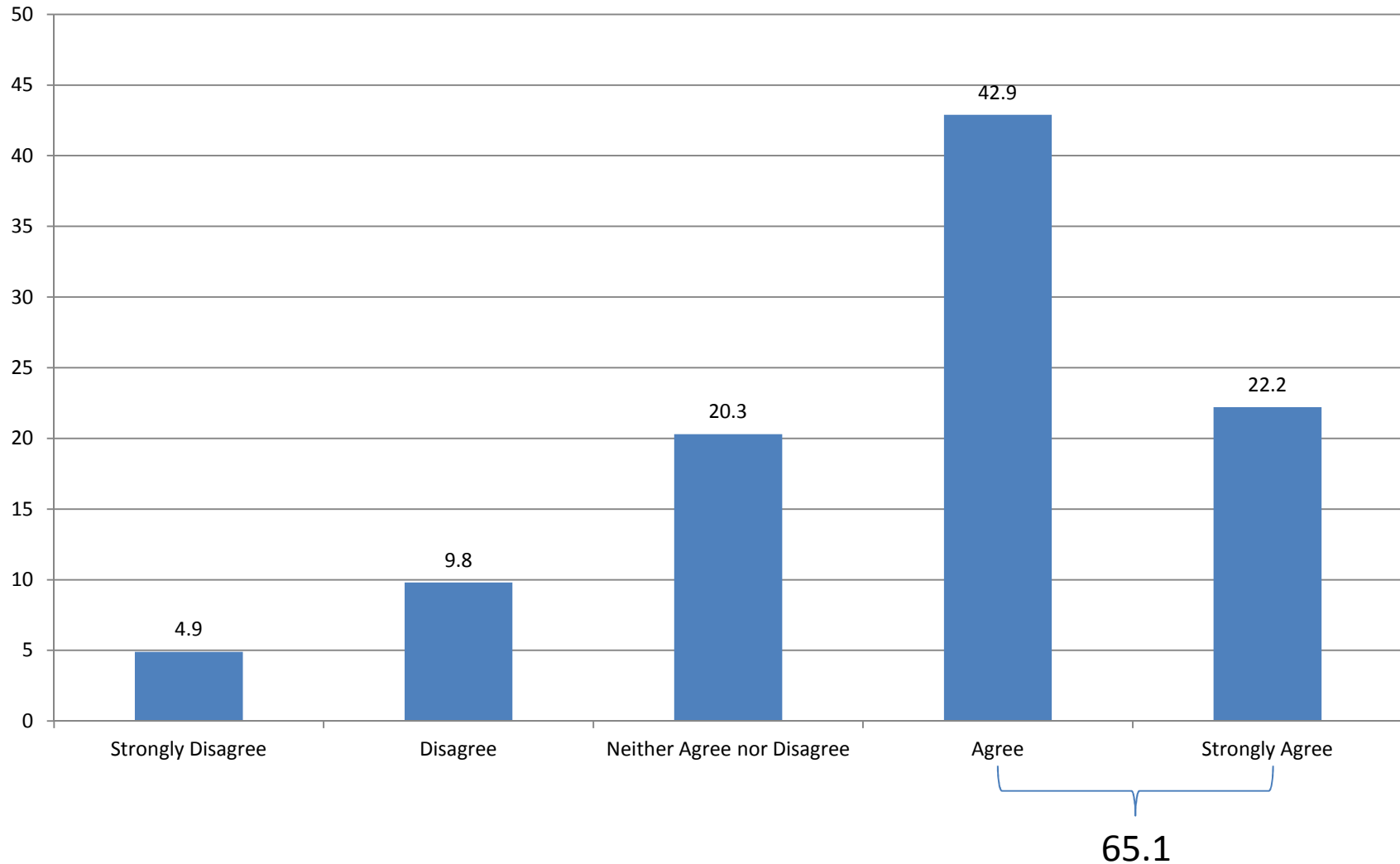
# Learned from working on a team project



# I liked doing a team project rather than 4 assignments on my own



# Team project grade should include peer evaluation





# Written Feedback

- 111 (24.1%) students gave written feedback
- 31.5% (35/111) were positive comments about the projects.
- Most of the negative comments concerned:
  - 1) teammates who did not contribute
  - 2) the project did not prepare them for the midterms or final exam
  - 3) instructions for the project did not specify **exactly** what they were suppose to do

*“I liked the project because it gave insight on what it's like to actually conduct an experiment and how to work in a team. I didn't like the project because it was not helpful when it came to learning the course material. When the work is split up between the team members, no member is exposed to all the topics in the course. The assignments would be a better way for us to learn the material but the project is a better way for us to learn how to apply the material.”*

*“I liked project. I wish I could evaluate my team member more often. One person didn't do ANYTHING, so they deserves a worse mark. What I also liked about this project is that we can't plagiarize. So many students plagiarize during assts, but for this, we can't plagiarize! We're forced to actually learn and apply the models because it is transparent when we don't actually.”*

*this was hard as f---*

# Summary

- The projects provided the students with a better understanding of the difficulties in making conclusions based on data which are subject to variability.
- For many students, the project failed in the student's primary (only?) goal of exam/test preparation.

# TA Experience

- We also conducted a paper survey of the TA's regarding their experience.
- Response rate was 100% (15/15).
- We had hoped that the TA's would benefit by developing mentoring skills and a better understanding of statistical consulting.
- We also hoped that they might find mentoring students more interesting than marking assignments.

# Summary of TA responses

- 9/15 agreed with the statement “I learned more about the analysis of real world data as a TA of team projects.”
- 13/15 agreed with the statement “I was able to give good advice to my teams.”
- 5/15 disagreed with the statement “I enjoyed my involvement in these projects more than marking assignments.”

# Student Feedback on TA's

*“I did not find the TA helpful at all. The TA could never answer our questions, hardly provided any advice, and in some cases was not even aware of what we were supposed to submit for our projects. The TA meetings were a complete waste of time. However, I usually do not like team assignments, but I had a great group to work with this time around, so I did not hate the project.”*



# Summary

- *The degree to which the TA interaction was/was not beneficial depended critically on the TA buy-in to the project goals.*
- *Some TA's expected only to mark, and were out of their comfort zone mentoring groups of students.*

# Conclusions

- Team projects are worth the effort. Students do gain an appreciation for analysing data as well as teamwork experience.
- For sure we pushed everyone out of their comfort zone.
- There are a number of changes we could incorporate to make the experience more positive for everyone involved.

# Team Formation Issues

- 1) Determine ways of dealing with issues related to team formation using D2L.
- 2) Decide how to deal with late enrolments.
- 3) The tutorial time for section 002 greatly helped with forming and scheduling the teams. Tutorial times should be scheduled for all sections.

# Projects and Practice Problems

- 1) Clear instructions regarding the desired learning outcomes of the team project. Make it clear that the project is not a replacement for the usual assignments.
- 2) In addition to projects, make problems available with solutions so students can obtain the practice they need to be successful on midterms and final exam.
- 3) Include peer evaluation as part of the team project grade. Indicate clearly how teams should deal with team members who do not contribute equally to the project.

# Projects and Practice Problems

4) Create better guidelines for sources of data (no census data) and augment the provided list of program-specific data sources. Some of the most interesting datasets were collected by the students themselves using survey instruments like SurveyMonkey. Include examples of experiments students can conduct themselves without having to obtain ethics clearance.

# TA Issues

- Arrange with department graduate officer to assign TA's who are interested in mentoring students working on team projects.
- Ensure that TA's are assigned with different backgrounds and from different programs so that they are not in the same courses.

# Final Conclusion

- Only difference between sections 001&003 and section 002 seems to be on the final course average.
- Who is the better instructor?

# Average final marks

