

GENDER EFFECTS IN A SMALL GROUP MATHEMATICAL PROBLEM  
SOLVING ENVIRONMENT OF MATURE UNDERGRADUATE STUDENTS.

victor Parsons  
University of Greenwich

Abstract :

In recent years the importance of mathematical investigations with the use of open ended problems as a means of developing mathematical processes has been an important factor in developing innovative undergraduate mathematical curricula. This study investigates the different perceptions of small groups of undergraduates undertaking such a programme of instruction and emphasizes that gender effects can impact on students undertaking such programmes, and should therefore be considered when implementing such a mathematical learning environment.

INTRODUCTION.

The comprehensive literature review by Burton (1994) and other related studies has indicated that the impact of group dynamics (Isaacson (1994), Rogers (1994), Maccoby and Jacklin (1974) and Kaur (1994)); social interaction (Leder (1994), Barnes and Coupland (1994), Marr and Helm (1994)); subject differentiation, (Aiken (1976), Fennema and Sherman (1977), Ehrhart and Sandler (1987), Walden and Walkerdine (1985), Becker (1981)) and sex role stereotyping (Isaacson (1994), Hanna et al (1994)) are all possible gender variables that can influence such group problem solving activities. This study was designed to investigate which factors the mathematical problem solvers themselves had intervened and this was carried out using ethnographic semi-structured interviews developed in a pilot project at Reading University in 1992. The main research project interviews with the students undertaking the undergraduate mathematical studies, were conducted mid-way through their group problem solving investigations. The students were matched as closely as possible into different gender mix mathematical investigation problem solving groups all of similar ability. In addition quantitative data was collected that will not be detailed in this research report, but was reported by Parsons and Lerman (1994).

THE ETHNOGRAPHIC ACCOUNTS.

Anita (all women problem solving group) :-

"Everybody contributed, and at the end everybody could explain it. It was like a jigsaw with everyone contributing. It was not just one person coming up with the answer; there were bits for each person to do. So it was quite a positive experience, and we were all happy with our end answer as well. Because sometimes you're not happy, you haven't got a general formula; You know, its just sort of up in the air. So it was quite satisfying really.

I think that we get on well as group. Sometimes (in other groups) you can get someone who isn't willing to listen really. In our group you evolve your own style and within the group you also work within other peoples' way of doing things as well."

Barbara (mixed gender group) :-

"Let me try and find some good experiences. I don't know what the others said, but Colin seems to whiz ahead of the rest of us. Sometimes he goes off and solves the problem on his own, and sometimes we're left sitting there thinking, hang on a minute what's going on? Slow down. So sometimes like I'm not getting anything out of this myself, because he's done it; and he says to me, 'Oh this is how you do it.' I can follow what he's done but I haven't actually been allowed to work it out for myself."

Colin (mixed gender group) :-

"It's hard for all four of us to work together. See David and me both did electrical engineering and we've definitely got a kindred spirit. Eric's got more of an economics background but Barbara hasn't even done maths to degree level before, only to 'A' level. It usually ends up with me and David working on the problem and Eric and Barbara having to do another one. When Eric and Barbara go through a problem I gave them advice when they got stuck on the problem I'd chosen for them, because I knew I could do it. I always find it difficult working in groups. I prefer to do it on my own, because I can work out my own structure . . . . . I tend to be slower if I work in a group. It usually slows down my train of thought. I've got my own way of thinking and if I try and work through their logic it usually throws me out of what I'm thinking. I know what I'm doing; I don't build up in stages, but just look for a solution using trial and error for the whole problem. I'm competitive when solving mathematical problems. The mathematics involved in the mathematical investigations is easy. I'm far beyond that in my mathematical knowledge."

Frederick (all men group) :-

"I don't find working with the other people in the group terribly interesting. I think most people are like that. They tend to start on a problem by themselves and they tend to work on it just by themselves. Then if they don't make much progress they'll look around to see what other people have done. There wasn't much collaboration. We weren't working together as a team. I think in general people were working on problems by themselves . . . . . I prefer working on my own because I like to think about things that interest me as I am doing a problem, and they are generally not what interests other people. I find it very unenjoyable to work in groups because I find it very difficult to think about a problem if other people were constantly talking."

I find it very difficult to concentrate because I really wouldn't get much out of the problem myself.

It does depend actually on whether you are leading the group, you know suggesting to other people that they should do certain things in the group, then it can be enjoyable. But I found that all that was happening was that my thoughts were being interrupted and I found that very annoying. I'd just rather work on the problems by myself.

There are some of the problems which as a group you could look at and if I can immediately see a way of getting a solution then I could, you know, divide the problem up and give different parts to different people and that would be a very satisfactory way of approaching it. In our group though I thought the situation was that nobody was making any progress and the only way to make any progress was just to set about the problems by myself."

Gerald (all men group)

"It's not until you start participating in mathematical problem solving in the group, that you begin to gain confidence in mathematical problem solving and you stop yourself from panicking. If someone starts racing ahead because they've got more experience in using mathematical methods then the group begins to crumble you see. that is like our group. It split into sub-groups. I couldn't work with Frederick because of this ..\*.....\*.....

You see Frederick has you know got tons of experience, and has done tons of courses, and he has told us all about that. The other problem is that he's a very independent person. I think there is a very great imbalance in our group . ....\*.... As a result I tend to take a back seat if you like because I feel the others are just racing ahead. In our group people did not put their contributions to the whole group, despite you asking us to. I think in our group people prefer to talk to just one other person as opposed to talking to the whole group and having a round table discussion. I think people in our group were competitive because if they hit on an answer or they knew they were on the right track, they would race ahead, which I would describe as competi ti ve behaviour. I think Frederick is definitely very competitive. I think you can say fairly certainly Frederick wasn't cooperative and because of this he's the person I had least contact with in our group."

Henry (all men group)

"Well I found that group problem solving was a very intimidating experience because if you are like myself and you haven't any prior experience of tackling problems in a systematic way then you feel a bit left out of everything. I just felt excluded from our group. In our group there was a free for all situation which personally didn't allow me to feel very relaxed and able to work at my best.

## DISCUSSION.

The interview data demonstrates the powerful effect gender variables can have upon certain individuals in a group problem solving context. It suggests that simply organising mathematical problem solving on the basis of small group working where the students are encouraged to work cooperatively does not necessarily eliminate power relations being manifested within such groups, and that these may very well have a gender bias. It suggests that certain students working in such groups may not gain the benefits from such small group problem solving investigations as much research such as for example Cobb (1994) suggest they should.

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