COOPERATIVE, COMPETITIVE, AND INDIVIDUALISED LEARNING PREFERENCES: MATHS TEACHERS ARE DIFFERENT - WHY?

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The benefits and disadvantages of cooperative, competitive, and individualistic learning in school subjects has been considerably discussed in recent years. A coordinated set of three instruments (the "Learning Preference Scales") is now available for use by teachers and researchers in investigating the preferences of students, teachers, and parents. ***The Learning Preference Scale - Teachers*** *was administered to large samples of primary and secondary teachers in Sydney (N=619) and Minneapolis (N=342), and secondary teachers in the English Midlands (N=278). Differences among teaching subjects and between sexes are discussed. In all three locations, the learning preferences of Mathematics teachers were strongly oriented to competitive learning. Discussion is focussed on the pedagogical epistemology of mathematics teaching and learning, and on the belief systems of teachers.*

It has been recognised that the belief systems which teachers construct about the nature of their subject and the effective learning of it are powerful influences on classroom practice (Thompson, 1992). It has been proposed that teachers of Mathematics hold at least four "dominant and distinct views of how mathematics should be taught" ranging from a constructivist learner-focused view to content-focused and classroom-focused views (Kuhs and Ball, 1986). It can be argued that a constructivist position would favour problem-solving, social engagement, and self-awareness in the process of active investigation, whereas several of the other positions would emphasise drill-and-recitation, computational procedures, and performance measured against standard indicators. In harmony with the constructivist position, it has been argued that "the use of small groups will lead to more meaningful assignments and less time spent on needless review and individualized seatwork" (Good, Mulryan, and McCaslin, 1992, p. 167). A recent issue of **Cooperative Learning** featured this theme (Davidson, 1989). This study is an analysis of data on the cooperative, competitive, and individualised learning preferences of teachers, in which the preferences of Mathematics teachers are selected for special attention. The findings are germane to speculation about a prevailing epistemology which may inform the belief systems of many Mathematics teachers, and which may directly influence notions of "good practice" in large numbers of Mathematics classrooms.

METHODS

Instrument

Preferences for cooperative, competitive, and individualised learning modes were obtained by means of the **Learning Preference Scale** (Owens, Barnes, and Straton, 1990). There are 33 items, brief statements about a feature of learning by cooperating with others, by competing with others, or by working alone. Items referring to each of these learning modes are content-matched in 10 groups, and one additional group contains unmatched items. Each content group, therefore, contains three matched cooperative, competitive, and individualised items, and each preference subscale in the LPST, therefore, is composed of 11 items. Teachers respond to each item by indicating how "true" or how "false" the statement is for them. A four-point Likert response scale is used, and numerical values are assigned to the answers on a 4-3-2-1 basis, with 4 representing the strongest preference. For six items expressed in negative phrasing, the scoring is reversed. Three main subscale scores (minimum 11, maximum 44) are calculated for each teacher, indicating strength of preference for Cooperative, Competitive, and Individualised learning situations.

The version of the LPST used in England was identical to the Australian edition. The version used in Minneapolis was an "American Revision" in which three one-word alterations were made (e.g., "grades" substituted for "marks" in reference to assessment). These changes were minor matters of idiom rather than major ones of substance. A complete handbook including the LPST and its two companion scales for students and parents is now available (Owens and Barnes, 1992). Data from both England and the United States are included.

Sample

The Australian (Sydney) sample of teachers was drawn from more than 30 schools and in-service courses in the metropolitan area in the early 1980's. A total of 619 teachers completed the LPST, three quarters of whom were secondary teachers. Although a wide range of schools were sampled (single-sex, coeducational, government, Catholic), data were collected only from staff who voluntarily completed the scale. In some schools the entire staff participated; in others, fewer than half returned completed forms. Participants from primary schools were predominantly female, whereas secondary teachers were principally male; overall there were slightly more females in the sample. More than 80% had greater than three years of teaching experience (Table 1).

The American (Minneapolis) sample of teachers was drawn from nine schools in two suburban school districts in a major midwestern city in the United States in the early 1980's. A total of 342 teachers completed the LPST, two thirds of whom were secondary teachers. A linked set of schools (two elementary schools-one junior high school-one senior high school) was chosen in each district, with the addition of one more elementary school and an n-service group. All schools were public and coeducational. As in Australia, participation was voluntary, elementary teachers were predominantly female, and secondary teachers were principally male. Again, there were more females than males in the overall sample. More than 80% had greater than ten years of teaching experience (Table 1).

Insert Table 1

The English (Midlands) sample of teachers was drawn from 13 secondary schools and one in-service group in six Midlands counties in 1991. A total of 278 teachers from coeducational government and Catholic schools completed the LPST. There were more males than females in the sample, and participation was voluntary. No information on teaching experience was gathered from these teachers (Table 1).

Procedures

The teacher data in Sydney were gathered by the author with major assistance from collaborating teachers in a number of schools. In Minneapolis, the data were gathered by the author as a result of a direct personal appeals to school staffs, backed up by administrative reminders. In England, direct personal appeals assisted by collaborating teachers enabled collection of the data. Participation in each situation was voluntary and confidentiality was assured.

Results

A two-way analysis of variance was carried out for each of the three LPST scores with the three batches of data. The independent variables were Sex (2) and Teaching Subject (4 secondary only - England, 5 primary and secondary - Sydney, 5 elementary and secondary - Minneapolis). It is important to note that the Maths and Science teachers were combined in the data coding in Sydney and Minneapolis, while they were coded into separate categories in the England data. The main and interaction effects from the analyses of variance in the three separate locations are presented in Table 2.

Insert Table 2

Significant differences in learning preferences between male teachers and female teachers were found only for competitive learning in Sydney and Minneapolis. Males were more inclined to competitiveness than females in both locations. The same difference was noted in England but this did not reach significance.

Differences between teaching subject groups required additional analyses using standard tests of significance. The Scheffe Procedure was selected to follow a oneway analysis of variance of the data for each testing location. In several instances this conservative test of significance failed to clarify differences evident from the overall analysis of variance. In Sydney (Table 3A) this further analysis revealed that Infants and Primary teachers had greater preference for cooperative learning than secondary Maths/Science, and to some extent, Humanities teachers.

Insert Table 3A

Amongst secondary teachers, Maths/Science teachers and Social Science teachers expressed greater preference for competitive learning than Humanities teachers. Finally, Infants teachers had stronger inclinations toward individualised learning than secondary Maths/Science teachers.

In Minneapolis (Table 3B) there were no apparent significant differences amongst the groups of teachers for cooperative•learning despite markedly low scores from Maths/Science teachers, nor for individualised learning despite low scores from both Maths/Science and Humanities teachers.

Insert Table 3B

For competitive learning, Maths/Science teachers expressed stronger preferences than all Elementary teachers, and Humanities teachers had stronger preferences than Upper Elementary teachers.

In England (Table 3C) the only difference to reach significance was that Maths teachers expressed a stronger preference for competitive learning than Humanities teachers.

Insert Table 3C

When the three locations were combined into a single database, very strong differences became evident in preferences for learning (Table 4).

Insert Table 4 and Table 5

Sydney teachers are noticeably more competitvely and individualistically inclined, and less cooperatively inclined than•the teachers from Minneapolis or from the England Midlands Counties (Table 5).

DISCUSSION

The picture that emerges from this analysis is that secondary teachers in Sydney schools seem to function in a predominantly competitive-individualistic ethos, if learning preferences are any guide to teaching practices. These data from teachers are closely paralleled by similar data from students both in Sydney and in Perth (Owens, Nolan, and McKinnon, 1992). Both at primary and secondary level, students express strong preferences for competitive and individualistic learning in comparison with students from the same English and American schools used in this study. This is true particularly for the boys. Moreover, students from New Zealand schools seem also to be strongly inclined this way (Nolan, McKinnon, and Owens, 1992), leading one to postulate a stereotypically male, combative and confrontive "Antipodean mind-set". Teachers and students of this persuasion reinforcing each other's common values and practices create a distinct, and not necessarily healthy, web of expectations for schooling. It is, to say the least, a far cry from the conception of "humane learning communities" cogently advanced by Campbell and Robinson(1979).

Into this general ethos teachers bring the concerns of their particular discipline and the customs of subject matter teaching. The data from this study seem to show that both in Australia and overseas, teachers of mathematics are strongly inclined toward the use of competition in learning, and that they may look with some scepticism at the possibilities of small-group cooperative learning. This set of findings lends some credence to the conception of "teacher epistemologies" which has been advanced to explain characteristic ways in which teachers of different subject matter approach their tasks (Young, 1981, 1992). Such an epistemology for mathematics teachers, insofar as it is evident in preferences for learning, appears to contain the desire to demonstrate superiority, the need to strive to be best, the selection of tasks which lead to ranking of performance, tidiness of procedure, and direct comparison of results. An obvious question is "how does it happen?". To what extent are persons of this existing persuasion drawn to the notion of teaching mathematics, and to what extent are they trained to see the importance, indeed inevitability, of these aspects of teaching as they experience the combined power of discipline-based teacher education and professional socialisation?

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Table 1. Background Information For the Samples of Teachers in Three Countries Who Completed the Learning Preference Scale-Teachers

Location	N[a]	Sex	Experience	Subject/Level
Australia: Sydney	619	M: 281 F: 335	< 3 yrs: 127 > 3 yrs: 490	Infants: 64 Primary: 85 Humanities: 186 Social Science: 98 Science/Maths: 132 Industrial Arts: 19 Home Science: 14 Physical Educ: 6
USA: Minneapolis	342	M: 148 F: 188	< 10 yrs: 55 > 10 yrs: 276	Lower Elem: 28 Upper Elem: 89 Humanities: 67 Social Science: 35 Science/Maths: 48 Industrial Arts: 9 Home Science: 11 Physical Educ: 11 Special Educ: 23 Other: 7
England: Midlands	278	M: 141 F: 125	no information gathered	Humanities: 95 Social Science: 26 Science: 45 Maths: 40 Craft/Technolog y: 9 Home Science: 7 Physical Educ: 18 Special Needs: 13 Other: 1

[a] Some of the teachers in each sample returned incomplete information.

Table 2. Teaching Subject x Sex of Teacher Analyses of Variance of the Cooperative, Competitive, and Individualised Subscale Scores (LPST)

Source of Variance	df	Cooperation MS	F	Competition MS	F	Individualisation MS	F
Australia: Sydney		N = 564					
Subject	4	73	6.4***	48	2.8*	28	2.2
Sex	1	4.7	<1	332	19***	3.1	<1
Year x Sub	3	6.4	<1	18.5	1.1	5.3	<1
England: Midlands		N = 205					
Subject	3	14.7	<1	111	3.7*	1.5	<1
Sex	1	25.2	1.2	21	<1	1.2	<1
Year x Sub	3	9.9	<1	10.7	<1	13.9	<1
USA: Minneapolis		N = 267					
Subject	4	52.7	3.3*	77	3.1*	33.9	2.5*
Sex	1	3.6	<1	195	7.8**	1.3	<1
Year x Sub	4	4.4	<1	41.4	1.6	8.8	<1

** p < .001

Table 3A. Comparisons of the Learning Mode Preferences of Primary and Secondary Teachers in Sydney Using a Oneway ANOVA with the Scheffe Procedure (alpha=.05).

LPST Subscale Score	Higher Mean	Differs significantly from	Lower Mean
Cooperative Learning Preference	Infants	<---------->	Maths/Science
	Primary	and <---------->	Maths/Science Humanities
Competitive Learning Preference	Maths/Science Social Science	<---------->	Humanities
Individualised Learning Preference	Infants	<---------->	Maths/Science

Table 3B. Comparisons of the Learning Mode Preferences of Primary and Secondary Teachers in Minneapolis Using a Oneway ANOVA with the Scheffe Procedure (alpha=.05).

LPST Subscale Score	Higher Mean	Differs significantly from	Lower Mean
Cooperative Learning Peference	No Significant Differences		
Competitive Learning Preference	Maths/Science	<---------->	All Elementary
	Humanities	and <---------->	Upper Elementary
Individualised Learning Preference	No Significant Differences		

Table 3C. Comparisons of the Learning Mode Preferences of Secondary Teachers in England Midlands Counties Using a Oneway ANOVA with the Scheffe Procedure (alpha=.05).

LPST Subscale Score	Higher Mean	Differs significantly from	Lower Mean
Cooperative Learning Preference	No Significant Differences		
Competitive Learning Preference	Maths	<---------->	Humanities
Individualised Learning Preference	No Significant Differences		

Table 4. Oneway Analysis of Variance by Location of the Cooperative, Competitive, and Individualised Subscale Scores (LPST)

Source of Variance	df	Cooperation MS	Cooperation F	Competition MS	Competition F	Individualisation MS	Individualisation F
Testing Location: Sydney, English Midlands Counties, Minneapolis N = 1238							
Location	2	359	23.9***	1496	61.4***	393	29.4***

** p < .001

Table 5. Comparisons of the Learning Mode Preferences of Teachers in Sydney, English Midlands Counties, and Minneapolis Using a Oneway ANOVA with the Scheffe Procedure (alpha=.05).

LPST Subscale Score	Higher Mean	Differs significantly from	Lower Mean
Cooperative Learning Preference	English Midlands Minneapolis	<---------->	Sydney
Competitve Learning Preference	Sydney	<---------->	Minneapolis English Midlands
Individualised Learning Preference	Sydney	<---------->	Minneapolis English Midlands