Students' Perception of Co-operative Learning in Earth Science Fieldwork

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ABSTRACT *This paper reports on a small-scale study of students' perceptions of selected aspects concerning the organisation of, and learning from, fieldwork. Two main findings emerge. (a) In the choice of working partners, students either seek partners whom they regard as capable of making positive contributions to the fulfilment of the learning tasks, or they opt for friendship groups. In the case of the former, the qualities looked for are predominantly subject knowledge and subject-related skills: competence in the management of group learning does not appear as a major consideration. (b) Although the outcomes from group work were invariably judged to be positive, a large minority of students appeared to regard themselves as contributors to, rather than beneficiaries from, such work. These students judged the extent of their learning from group work as low or very low.*

Introduction

Previous work on group learning in science education (e.g. Kempa & Ayob, 1991, 1995; Howe *et al.*, 1990, 1992) has tended to focus on two main aspects, viz.: (i) the processes and interactions among learners that take place during group work; and (ii) the learning outcomes resulting from, and learning performances achieved in, group collaborative work. Relatively little attention has so far been paid to the exploration of students' views concerning group learning and its management. Whilst there are extensive data available to indicate why teachers often opt for group learning in science and what they expect to result from it, the views of their pupils or students have remained unexplored.

The study reported in this paper is an attempt to remedy this situation by exploring students' attitudes towards group learning (co-operative learning). The particular context chosen for the study was earth science fieldwork undertaken by groups of high school students in Israel.

The choice of fieldwork, as opposed to work in the confines of a classroom or laboratory, was thought to offer advantages in the context of this research enquiry because fieldwork is frequently conducted in a more open-ended and, hence, less teacher-directed form than laboratory-based work. Thus, aspects and issues of co-operation within groups and self-management of group work may come particularly to the fore in field activities. The emphasis in the present study was on two aspects: (i) students' views concerning the composition of working groups, including the selection of working

0263-5143/96/010033-09

partner(s); and (ii) students' perception of their learning from group work and of factors helping or hindering such learning.

Experimental Details

Student Sample and Experience of Fieldwork

The student sample chosen for the study consisted of 44 students from grades 10 to 12 (aged 16–18 years) of a senior high school in southern Israel. The gender ratio in the sample was exactly 1:1. All students were following a study programme in earth science, as part of their studies leading to the matriculation (Bagrut) examination. Fieldwork forms a regular integral component of this programme.

The general approach to the fieldwork has previously been described by Orion (1993). Its essential features are that it comprises a school-based 'preparatory' phase which is followed by the fieldwork as such. This is undertaken by students with the use of worksheets which suggest what observations should be made and also specify the problems to be solved during the fieldwork and subsequently. The work is concluded by a further school-based 'summary' phase which serves to review what has been learned and to integrate this learning into the broader programme.

At the time of conducting the present enquiry, all students had previously been exposed to a suffient range of fieldwork and laboratory experiences in earth science (as well as other sciences) to be able to furnish answers to the questions posed.

Questionnaire

The enquiry was conducted by means of a 20-item questionnaire in which the two issues indicated above were addressed. Some of the items asked for straightforward factual information, e.g. about students' experience of the formation of working teams and their composition. Other questions invited brief 'open-ended' statements, e.g. about students' perceptions of how learning activities in group work should be managed. No pilot administration of the questionnaire was carried out; however, all questions were initially scrutinised by several experienced teachers to establish their clarity and appropriateness.

The appendix gives an abridged list of the items featuring in the questionnaire, omitting questions concerning aspects not covered in this paper. For the sake of brevity, the layout of the questions in the questionnaire and the arrangement of boxes and grids for recording students' answers are not shown.

The evaluation of students' 'open-ended' statements was conducted in accordance with the strategy commonly adopted for 'network analysis' (Bliss *et al.*, 1983): all statements relating to a specific question were collected and then analysed in terms of the main categories into which they fell. The more detailed examination of answers within each category thus obtained allowed a semi-quantitative estimation to be made of the 'strength' of students' views and/or perceptions.

Administration

The administration of the questionnaire took place towards the end of the school year. No specific conditions were made concerning its completion.

Results and Discussion

As was indicated above, the total student sample was drawn from three different grades at the senior high school level and also comprised boys and girls in equal proportion. As part of the analysis of the questionnaire results, the influence of grade level and of gender on the responses to the questions was examined. It was invariably found that no such influence existed. Hence, the data are presented as originating from a homogeneous student sample. The results are presented and discussed in two subsections, in accordance with the research issues identified.

Students' Views on the Composition of Working Groups and the Selection of Working Partner(s)

Students' experience of group work in earth science covered collaboration, on different occasions, with one, two, three and even more peers. In the majority of cases (approximately 90%), students had been able to select their team members by themselves, as opposed to the selection having been made by the teacher. By and large, students expressed general satisfaction with their choice of working partners: only one in eight indicated that he/she would have preferred to work with a student or students not included in his/her team.

When asked to indicate what had induced or guided students in the choice of their working partners, four categories of answers emerged, as is shown on the right in Fig. 1. It may be argued that, since the first two of these categories relate to the group work task itself or the prospect of success in it, they may be linked as shown on the left of Fig. 1. Similarly, the remaining two categories may be linked together as concerning personal relationships and interactions with a group. This, too, is indicated in Fig. 1. The categories in Fig. 1 account for nearly 80% of all answers received. The remaining 20% of answers were all compatible with those in Fig. 1, but gave insufficient information to be included in the classification. For example, an answer like 'I'd choose the mates who are suitable for me' fails to express a clear reason for choice and is, hence, not classifiable within the above scheme.

Two important conclusions may be drawn from the information and data in Fig. 1.

(a) At least half of the students, in choosing working partners, appear to be influenced by the nature or requirement of the task itself, rather than by the existence of established friendship or personal relationship patterns. This does not, of course, preclude some overlap between these two broad response categories. However, it is interesting that, in formulating their answers, students clearly articulate different reasons for their choice of partners.
(b) Within the group of 'task-related reasons', those pertaining to 'working relationships', i.e. the ability to collaborate effectively, have more preponderance than those relating to a successful outcome from the work.

An alternative, though complementary way of looking at Fig. 1 would be to argue that of the four categories of answer, three focus distinctly on relationships with others, regardless of whether these concern only working or both working and personal relationships. If this line of argument is pursued, it may be suggested that for the majority of students the critical issue concerns the *process* of the group work, rather than its outcomes.

In a further set of questions, students were invited to indicate what they thought to be a preferred make-up of working groups in terms of (i) the knowledge and skill levels of

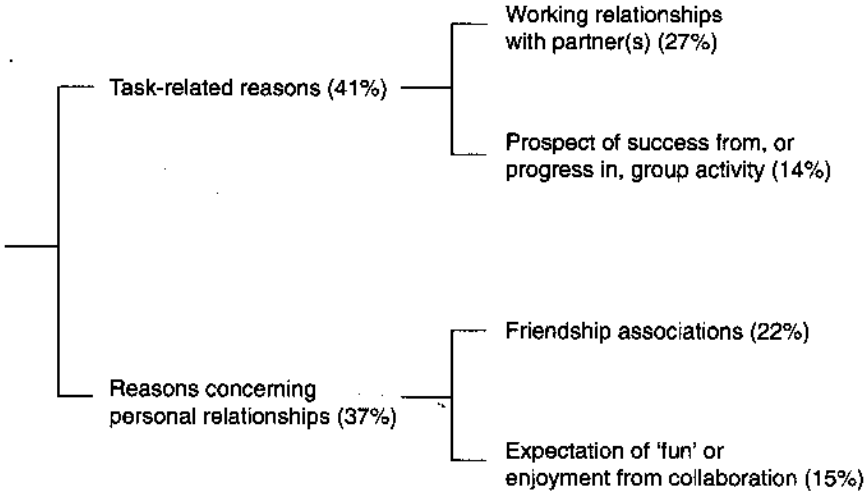

FIG. 1. Network showing the distribution of factors influencing students in the choice of working partners in group work.

group members and (ii) their interest in or commitment to the learning task. Essentially, students were asked to indicate whether, in relation to each of the two variables, they preferred homogeneity or heterogeneity within working groups. Table I summarises the results (rounded percentage figures given).

As the data in Table I indicate, two considerations concerning the composition of working groups are in evidence. When knowledge and skills possessed by group members are considered as criteria for the choice of working partners, a clear preference is expressed for a variety of these attributes to be represented within a group. At the same time, however, students appear to look for a high degree of uniformity in the interest orientation of group members towards the group learning tasks. It may be thought that students regard the latter as an essential prerequisite for effective learning from group work; at the same time, their preference for heterogeneity of skills and knowledge levels clearly suggests that they are aware that much can be gained, in terms of learning, from a variety of strengths and insights that different group members can contribute to the work.

Students' Perception of Their own Learning from Group Work

Students were asked to reflect on the general performance of their working groups during fieldwork, with respect to the learning tasks that had been set, and also to rate the extent to which the team working had contributed to the successful accomplishment of the task.

TABLE I. Students' preference for different types of group composition, as a function of two characteristics of group members

	Preference for	
Variable	Heterogeneous composition (%)	Homogeneous composition (%)
Knowledge/skill level	90	10
Interest orientation	25	75

TABLE II. Students' perception of their group's performance on group learning tasks

Variable judged	Students' rating of performance on variable (%)			
	Very high	High	Moderate	Low or very low
Performance of group as a whole on learning tasks during fieldwork	25	65	10	—
Contribution of team working to the success in solving the learning tasks	25	60	15	—

TABLE III. Students' rating of the personal (learning) benefit derived from group work and of their contributions to the team's performance

Variables	Extent of benefit from/contribution to group work		
	Very high or high	Moderate	Low or very low
Learning from peers in group work	60	—	40
Contribution to team's learning performance	60	35	5

Judgements were made on a 5-point rating scale, ranging from 'very high' to 'very low'. Table II summarises the findings.

The data in Table II indicate that no responses to the 'low' or 'very low' reply categories were received. It appears that, in general, students have a positive perception of the educational benefits derived from group working in earth science fieldwork: this applies to their perception of both their group's performance in the learning tasks and the effect of the team's effort on the accomplishment of the learning tasks. There are some variations in the ratings of these aspects, but the most noteworthy point is that no negative perceptions appeared to exist at all.

Another line of enquiry concerned the extent to which students felt they personally had benefited from their involvement in group work and the extent to which they thought they had contributed to it, respectively. Again, these variables were assessed on a scale, as described above, but reduced to 3 points. Table III summarises the responses received.

Students' perception of their own learning from group work produces an interesting dichotomy: there is a reasonably even division between those who claim to have benefited much from group work and those who judge the benefit derived from such work to have been low or very low. The picture for the second variable, i.e. the level of students' perceived contribution *to* group learning, is similar though not quite so pronounced in that there was a reasonable return for the 'moderate' category.

On the basis of the 'learning *from* peers' figures, it would not be unreasonable to argue that students see themselves either as contributors to, or as beneficiaries from, group learning activities. The fact that the figures for the 'contribution to team's learning performance' appeared somewhat more positive than those for 'learning from peers'

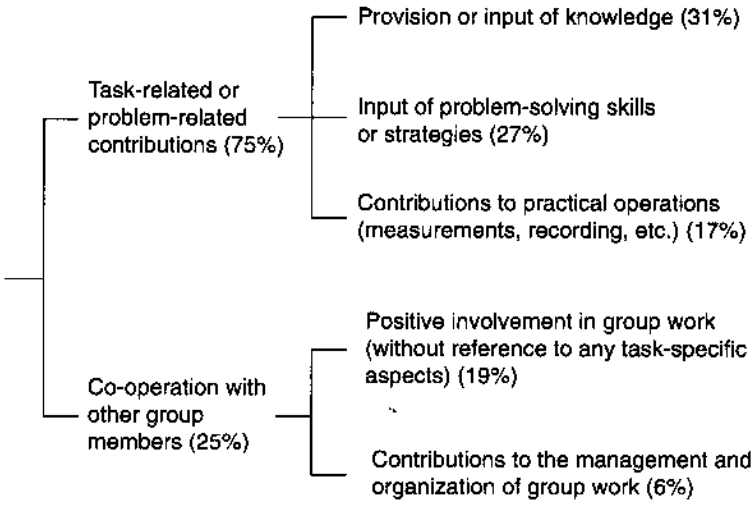

FIG. 2. Analysis of students' perceptions of their contributions to group work.

suggests that students may perhaps hold an inflated self-image of their role as contributors to group learning.

A further question asked students to identify, through open-ended responses, the nature of their contributions to their group's learning performance. Answers received were again evaluated using the procedure characteristic for network analysis. Broadly, five categories of contribution could be identified, as follows:

(i) contributions to the group's activity through an input of knowledge and previously learned information;
(ii) provision of guidance and suggestions about problem-solving strategies and procedures;
(iii) contributions to the execution of practical operations and tasks ('hands-on' contributions);
(iv) direct involvement in the group's activities (without specifying the nature of that involvement); and
(v) contributions to the management and organisation of the group work.

The first three of these categories may be thought of as relating to aspects of the tasks or problems to be addressed during the fieldwork, whilst the last two categories appear to relate to aspects of working relationships within groups. Figure 2 expresses this and also gives data expressed as percentages showing the preponderance of answers in the various categories.

The picture to emerge from Fig. 2 is that most students view their contributions to group learning to be provided through task-related inputs, especially in the knowledge and problem-solving skills domain. Contributions to interpersonal aspects of group work which are often of crucial importance for the success of teamwork, do not feature strongly in students' minds. Whilst this may suggest that students are perhaps insufficiently aware of the importance of issues like group management, negotiations, etc., for success in group work, their answers to another question showed that, in practice, they engaged actively in management activities relating to their group work. Indeed, 68% of responses received to the question, 'How was learning in group work managed?'

indicated that students operated on a 'democratic' management of their group learning; tasks to be done by individuals were determined by the group as a whole and then shared out; only 6% of the responses referred to a strict teacher control in the management of group work.

Finally, in relation to this section, students were asked to indicate, in an open-ended way, what particular features in group learning they had valued. The answers received divided broadly into four major categories, as follows:

(i) the opportunity to engage in collaborative work (on specific learning tasks), instead of working on one's own (33%);
(ii) the support and help received from, and shared with, others in attempts to solve learning tasks (23%);
(iii) the opportunity to work with friends (26%); and
(iv) the opportunity provided by group work to 'socialise' with others and have 'fun' (18%).

The extent to which answers reflected these categories is indicated by the percentage figures following each descriptor.

It is worth noting that the foregoing categories resemble closely those given in Fig. 1, in that they again divide into a task-related and an interpersonal group, respectively, in a relatively balanced way.

Conclusions

The study reported in this communication sought to examine students' views on team learning in the context of fieldwork in an earth science programme. Particular attention was paid to two aspects, viz.: (i) students' views on the composition of working groups and choice of working partners; and (ii) students' perception of their own learning from and in team activities.

Although the study was confined to a relatively small student cohort, a number of general findings emerged. These may be summarised thus:

(i) In choosing their working partners (in the majority of cases, working groups had been formed by the students, without teacher intervention), students seemed to be divided between choosing partners because they could contribute to the solution of learning tasks and the choice of partners for reasons of personal relationship. In the case of the former, a significantly larger proportion of students seemed to be concerned that a fruitful working relationship would prevail than with the likely success on the learning tasks.

(ii) Concerning the qualities and skills that students like to see represented within their working teams, it appears that a variety of knowledge and skill levels is thought to be desirable. At the same time, however, students believe that their working groups should be largely homogeneous in terms of interest orientation of members. This suggests that students appreciate that the presence of a variety of expertise can be helpful in group learning, provided that there exists a common commitment.

(iii) The general view held by students was that their team activities had been successful in terms of generating a solution to learning problems and also as a method of learning. However, a significant minority of students felt that their own personal learning benefit from group work had been rather low. The evidence suggests that these students saw themselves mainly as contributors to, rather than beneficiaries from, group work.

(iv) There appears to exist a general tendency for students to judge their own personal contributions to group work largely in terms of their knowledge or skill input, as it relates to the solution of particular learning tasks, or their actual work on generating such solutions. Issues of management of group work, including such matters as division and distribution of learning tasks and the organisational aspects, did not feature strongly in students' perceptions of their contribution, although there was evidence that students engaged in these aspects also.

On the whole, the findings obtained in this study give a positive view about students' reaction to team working. However, it has to be acknowledged that they relate to the specialised context of fieldwork. Whether they would equally apply to laboratory-based work cannot be judged.

Another question that arises from the present findings concerns the relatively high proportion of students who claimed to have derived little or no 'learning benefit' from their involvement in group work (cf. Table III). If these students' judgement was made mainly in terms of task- or problem-specific aspects of group work, as might be suggested by the breakdown in Fig. 2, one might ask whether such students might not have derived benefits in other areas, e.g. interpersonal skills, management and organisational skills, all of which are essential facets of group learning. Only further research can resolve these issues. What the present study indicates is that, generally speaking, group working is highly acceptable to students.

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Appendix. Abridged list of items in questionnaire

1. My working team comprised the following number of students:
   Two *Three* *Four* *More than four*
2. State whether you had had any previous experience of team working during a field trip.
   Yes *No*
3. By whom were your team members selected?
   By the teacher *By the students* *Other process (specify)*
4. Would you have preferred to work with any other students who were not included in your team?

   Yes *No*

   Explain your answer.
5. In your opinion, on what basis should the members of a working team be chosen?

   Friendship relations *Learning abilities* *Other (specify)*

   Give a reason for your answer.
6. In your view, what should be the knowledge level among the members of a working team?
   Similar *Different* *Other (specify)*
7. What should be the interest level among the members of a working team?
   Similar *Different* *Other (specify)*
8. How do you rate the performance level of your learning team in solving the learning tasks which you had been set for the field trip?
   Very high *High* *Moderate* *Low* *Very low*
9. What, if anything, might have been done by your group to improve its learning performance? Please specify.
10. How much did the team learning approach contribute to your *own* learning performance during the field trip?
    Very much *Much* *Moderate* *Little* *Very little*
11. Indicate the extent to which you learned from your peers during the field trip?
    Very much *Much* *Moderate* *Little* *Very little*
12. How do you rate your contribution to your team's learning performance during the field trip?
    Very high *High* *Moderate* *Low* *Very low*
13. In what way(s) did you contribute to the learning performance of your team? Please specify.
14. Briefly state how the learning activities in your group were managed?
15. Briefly state what particular aspects you valued in your experience of working in a team during the field trip?