

# Raising awareness in children of group skills using an expert system

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**Abstract.** An expert system *cannot* teach group skills to children aged 9 to 11. It can, however, offer support by encouraging reflection throughout a task. The implementation described uses a model based on Schön's theories of reflection. If the reflective process is clearly described, the children find it does not impede them in the task. The method of recording affects the opinion. If recorded on paper the perception of how well the group worked together can be used to predict the assessment given by the researcher. Further work is needed to identify how this model can be transferred to a computer-based expert system. It was found children have difficulty working independently at a shared machine despite dual key control.

## 1. Introduction

Teachers are encouraged to use group work as it improves children's academic and social skills [1]. Group skills include agreeing a goal, justifying arguments, and taking responsibility. Computers can also assist as they encourage discussion, provide a shared representation and are motivating [2,]. This research considers whether an expert system can assist the development of group skills for 9-to-11 year olds working at one computer.

It is suggested that group skills may be taught through discussion and reflection [1]. An expert system can support this approach by reminding the children to reflect on how they are, and how they should be, working together. This can have a significant improvement on task performance [3]. It is hypothesised that awareness of group skills would be further raised if the system provided feedback consistent with the teacher's opinion of the group's performance. This would assist the children in determining the accuracy of their definitions and self-assessments developed during the reflective process [4].

Currently, assessment of group work is predominantly based on a combination of discourse analysis, task performance and body language [3, 5]. This research proposes an alternative approach to gathering data about the group's interactions. By using an expert system to stimulate children to reflect on their use of group skills their self-assessment of performance, which is a side effect of this process, provides the necessary information. The model described below has been implemented and has been tested to measure the impact of reflection and the effect of the medium for recording performance assessment.

### [1] **Stimulating children's reflection: the model for recording interactions**

The model is designed to encourage reflection. At the start of the task, pairs of children are asked to select three criteria from a list of group skills (e.g., "listen to each other") or to create their own. At intervals during the activity, one of these skills is randomly selected and the children are asked individually to assess the proportion of time that they used it,

using a 5-point scale (1 = none of the time, 5 = all of the time) [6]. The period assessed is the time since the last request. Using the children's responses, heuristics within the model then identify a question for oral discussion. It may ask the children to agree: i) an example, ii) an explanation for the discrepancies between the opinions, or iii) a plan to improve skill usage. The question acts as a specific prompt for *reflection-in-action* [7]. The discussions aim to clarify definitions and perceptions. At the end of the task the children are asked to record their opinion overall. This promotes reflection on performance, which assists planning improvements in future behaviour, i.e., *reflection-on-action* [7]. This process is not detrimental to task performance [8].

The effectiveness of the model is dependent on the children performing the tasks requested. If the record of interaction is accurate, the expert system can provide an assessment similar to the teacher's, using a combination of the children's reflection-in-action and reflection-on-action scores.

### **3. Study to determine the effect of the implementation and the medium**

#### *3.1 Aims and Method*

The study aimed to determine i) whether children thought they could simultaneously reflect on group skills and perform a task, and ii) the effect of the medium on the implementation. It was conducted with 42 9-and-10 year olds from two primary schools, where the average level of achievement was similar to the UK national average. The children were divided into two groups: A (15 pairs) and B (six pairs). Both groups performed the same spreadsheet task in parallel with the reflection process described above. Group A was given the task on printed cards and used pen and paper to record their opinions. Group B used a computer version with dual-key control for entering their opinions; one child using the mouse and the other the keyboard. The session for both groups lasted 45 minutes.

A rule was randomly selected after approximately three sub-tasks. The same heuristics were used to select a discussion question. All the children were asked to provide an overall assessment as a percentage at the end of the session. They were also asked whether being asked to reflect impeded their performance of the task.

In addition, the researcher assessed how well each group worked together during the exercise, using criteria developed beforehand with the teachers. Marks were added for asking questions, giving verbal or non-verbal explanations and reaching a consensus. Marks were deducted for talking simultaneously, seeking external help without attempting the problem or not looking at the task or each other.

#### *3.2 Results*

All the groups completed the spreadsheet task with similar levels of practical assistance from the researcher. None of the children felt that being asked to reflect on their behaviour was detrimental to understanding the task. The discussions on group skills never lasted more than a minute. At least 70% of the children in both scenarios stated they followed their chosen rules over three-quarters of the time.

Children in Group A frequently hid their paper from their partner while writing. Their opinions disagreed 32.73% of the time, which often led to spontaneous discussion. Children in Group B conferred in approximately two thirds of cases, but largely in concise speech or through gestures. Their opinions differed 10.53% of the time. The discrepancy between the two groups is significant ( $p > 0.1$  using Chi square).

All the final self-assessments of group performance were higher than the researcher's assessment. However, there is a strong correlation between the final reflection and the

reflection during the task in Group A ( $R = 0.7407$ ,  $p > 0.001$  using Pearson product moment correlation). This relationship is not found in Group B's results.

### 3.3 Discussion

The results show that children have a high estimation of their use of group skills and believe that the process of reflection does not impede their task performance. This is supported by the short time spent in discussing group skills in relation to the time spent on the task.

Although the medium does not impact task performance, it does affect children's opinions. The greater range of views from Group A suggests that the children are reflecting individually. One explanation is that this medium is non-judgemental: i.e., the children believe that both their opinions are valid. In contrast, children in Group B were less likely to reflect independently. Possibly they have a preconception that the expert system has monitored them and requires a "right" answer.

The correlation between "in-task" and "post-task" scores for Group A indicates that reflection during the task has influenced the final assessment. Children are becoming more aware of their actions [9]. From these scores it is possible to predict the mark given by the researcher with a significant degree of accuracy ( $R = 0.531$ ,  $p > 0.05$  using Pearson product moment correlation). These children may also benefit from their spontaneous discussions about group skills.

Although agreement between partners on a score should not imply that no discussion has occurred, the most productive discussions seem to occur when the partners' scores differ. The higher incidence of identical scores between partners using the computer indicates a lower level of independent thought, which has implications for assessment by a computer-based expert system.

## 4. Conclusions and Future Work

The study indicates that children can accurately reflect on their behaviour in a task where prompts for reflection are well structured. Assuming the children's assessments accurately reflect their views, an expert system based on the model could generate an overall assessment similar to the teacher's. Further work needs to ascertain why a shared computer does not appear to encourage individual reflection. This work might focus on i) stimulating discussion prior to using the expert system, or ii) generating discussion questions if marks are consistently similar.

### References

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