

Motivational and Cognitive Processes Influencing Tutorial Groups

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The tutorial group is an essential element of a problem-based curriculum. In a tutorial group, students discuss problems or cases that need further self-study. A tutorial group is a specific form of cooperative learning. There is a substantial body of research on cooperative learning based upon four major theoretical perspectives.¹ These perspectives, which are outlined in the next paragraph, are used in this study to expand our understanding of processes taking place in tutorial groups.

Slavin¹ distinguishes four major theoretical perspectives in research on cooperative learning. The first perspective is a motivational one. It stresses the importance of group members' encouraging their peers to exert maximum effort. The idea is that a group motivates each group member, because a member can attain his or her personal goals only if the group is essential. The second perspective stresses the social cohesiveness of the group. This implies that a group develops team spirit that encourages the members to care about the group, because they wish the group to succeed. The third is a developmental perspective. The idea is that interactions among group members, such as discussing, presenting, and hearing each other's viewpoints, play an important role in student learning. Through mutual feedback and debate, peers motivate one another to abandon misconceptions and to search for better solutions. The fourth perspective deals with cognitive elaboration. Elaborations take place when group members answer each other's questions.² One of the most effective means of elaboration is explaining the material to someone else. The first two perspectives emphasize motivational explanations and the next two focus upon cognitive explanations.

When these four perspectives on cooperative learning are translated to successful tutorial groups, four advantages of learning in a tutorial group can be inferred. First, because a group encourages its members to exert maximum effort, a tutorial group positively influences students' motivation to spend time on their studies. Second, the tutorial group creates a team spirit that encourages the members to help the group succeed. Third, in a successful tutorial group, students have ample opportunity for interactions in which they can learn much from one another. In a study conducted by De Grave, Boshuizen, and Schmidt,³ it was demonstrated that the tutorial group induces cognitive conflict (disagreements among students about knowledge) leading to conceptual change. Fourth, in successful groups students elaborate on new information through discussion. The effect of elaboration on the comprehension of information in tutorial groups was demonstrated in a study conducted by Schmidt et al.⁴

However, not all tutorial groups are perceived by students to function optimally. Until now, no research of dysfunctional problem-based learning groups has appeared in the literature (according to Hitchcock and Anderson⁵). However, the four perspectives in research on cooperative learning provide us with information to formulate ideas about what might go wrong in these groups. One or more of the advantages mentioned in the previous paragraph can turn into a disadvantage. For example, instead of encouraging peers to exert maximum effort, a group might discourage group members to participate actively, perhaps because only a few students prepare the tutorial group meetings. In this situation some students let others do the work for them ("sponging"). If group members discover that some students let others do the work, they too start to con-

tribute less to the tutorial group's activities (withdrawing). Instead of social cohesion, then, the tutorial group's atmosphere becomes "social loafing."¹ Other explanations for dysfunctional groups focus on cognitive processes. Students may too easily accept each other's contributions in the discussion or they may inadequately explain the material to others.

The central aim of this study was to expand our understanding of motivational and cognitive influences on tutorial group processes. The first question dealt with testing whether a linear relationship existed between a tutorial group's success and motivational and cognitive processes. The second question dealt with assessing the weight of motivational and cognitive processes in the prediction of successful tutorial groups. The third question was aimed at investigating how motivational and cognitive processes influence each other. In order to answer the three research questions, a questionnaire was developed based upon the motivational and cognitive theories of cooperative learning. The instrument's reliability was investigated as well as its construct validity before it was used in answering the three research questions.

Method

Data from 39 tutorial groups from the academic year 1997-98 at the medical school of the University of Maastricht were used. The tutorial groups were almost equally divided across the four curriculum years. In total, students in 40 tutorial groups were asked to respond to a questionnaire; the response rate was 98%. The numbers of students involved in the groups ranged from five to ten. The regular tutorial group size is ten students, which implies an average response rate of 73% of the students.

Four possible motivational aspects were considered: (1) motivation; (2) cohesion; (3) sponging; and (4) withdrawing. Based on the cognitive theories another two possible dimensions of group processes were also considered: (5) interaction and (6) elaboration. A questionnaire was developed comprising 13 statements that reflected these dimensions; for example, "As a member of the tutorial group I felt uncomfortable if I did not prepare the tutorial meeting" (dimension 2), and "Some group members intentionally withheld information they had gained during their self-study activities" (dimension 4). The numbers of statements per dimension varied between two and three. The students filled out the questionnaire at the end of a six-week unit. The statements were rated on a five-point Likert scale ranging from 1, "strongly disagree," to 5, "strongly agree." One of the items in the questionnaire asked the students to give an overall score (ranging from 1 to 10, with 6 considered "sufficient") to the productivity of the tutorial group. This judgment of the tutorial group's overall success was considered as the dependent variable; the six dimensions were considered as independent variables.

For all analyses, data were aggregated at the tutorial-group level by computing average scores across students for the individual groups. The internal consistency of the six dimensions was tested by calculating alpha coefficients. Construct validity was assessed in a confirmatory factor analysis. In the confirmatory factor model, all common factors (i.e., dimensions) were correlated, observed variables (i.e., statements) 1 and 2 were affected by the first common factor, observed variables 3 and 4 were affected by the second common factor,

and so on. Furthermore, all observed variables were assumed to be affected by a unique factor (error in each variable), and no pairs of unique factors were correlated. The AMOS 3.6 program⁶ was used.

The first research question, aimed at testing linear relationships between the tutorial group's success and the six dimensions, was answered by conducting a one-way analysis of variance in which the average scores of unsuccessful, moderately successful, and highly successful tutorial groups on each of the six dimensions were compared. The second research question, aimed at assessing the weight of each dimension in the prediction of a tutorial group's success, was investigated by a linear regression analysis (method: forward). The third research question, aimed at investigating how the six dimensions influenced each other, was answered by applying a linear structural model to the data. The AMOS 3.6 program⁶ was used.

Results

The mean ratings for the dimensions were, respectively, 3.5, 3.6, 2.3, 2.5, 3.3, and 3.4 (on a scale of 1–5). The standard deviations corresponding with these mean scores varied between 0.4 and 0.6. The alpha coefficients for the dimensions were, respectively, 0.93, 0.54, 0.55, 0.77, 0.87, and 0.75. For dimensions 2 (cohesion) and 3 (sponging) these alpha coefficients were relatively low, whereas the coefficients for the other dimensions were satisfying. The correlations between common factors (i.e., dimensions) varied between 0.35 and 0.80. This suggests that some factor scores provide limited unique information across the six dimensions. The results of the confirmatory factor model showed $\chi^2 [50 df] = 58.61$, $p = .19$, a root-mean-square residual of 0.02, a goodness-of-fit index of 0.83, and an adjusted goodness-of-fit index of 0.69. In general these results indicate a good fit.⁷

To test for any linear relationships between the individual dimensions and the tutorial group's success, a distinction was made between unsuccessful groups (in which the overall rating of a tutorial group's productivity was lower than 6 on a scale of 1–10), moderately successful groups (a score of 6–7), and highly successful groups (a score higher than 7). For all dimensions the average scores differed significantly ($p < 0.5$), as can be seen in Table 1. The results show that the lower a tutorial group's productivity, the lower its motivation and cohesiveness, the higher its number of spongers and the number of students withdrawing, and the less its interactions and its students' elaboration.

The linear regression analysis showed that the interaction dimension had the highest weight and explained 71% of the variance in the dependent variable (the productivity score). Two other dimensions also contributed significantly but to a lesser extent to a

tutorial group's success. Adding the motivation dimension resulted in 77% and then adding the sponging dimension resulted in 79% of the variance explained.

A linear structural model was developed to assess the relationships among motivational and cognitive processes in tutorial groups. The model is outlined in Figure 1. The left part of Figure 1 comprises dimensions related to cognitive processes and the right part, to motivational processes. The elaboration dimension is assumed to directly influence the interaction dimension (a positive relationship). The group's cohesiveness is considered to directly influence the group's motivation (a positive relationship). The group's motivation is assumed to influence sponging, i.e., if the group is highly motivated, the number of spongers will be low (a negative relationship). Sponging is assumed to directly influence the number of students withdrawing (a positive relationship). Withdrawing is assumed to result in less cohesiveness of the group (a negative relationship). Interaction and motivation are assumed to directly influence the tutorial group's productivity, whereas all other dimensions are assumed to indirectly influence the tutorial group's productivity. The motivation dimension is assumed to play a central role in the model and positively influences both cognitive dimensions. All dimensions were assumed to be affected by a unique factor (error in each dimension). The unique factors have a regression weight of one in the prediction of the tutorial group's productivity, and no pairs of unique factors are correlated. The results of the model as specified in Figure 1 showed $\chi^2 [12 df] = 25.72$, $p = .01$, a root-mean-square residual of 0.04, a goodness-of-fit index of 0.85, and an adjusted goodness-of-fit index of 0.64. Thus, the hypotheses formulated about the relation between the dimensions were confirmed by the data.⁷ Interaction and motivation both directly influenced a tutorial group's success, whereas elaboration and cohesion indirectly influenced a group's success.

Conclusion

The major finding of this study is that there were linear relationships between a tutorial group's success and all motivational and cognitive dimensions. In addition, it was found that the interaction dimension had the highest weight in predicting a tutorial group's success; the percentage of variance explained was 71. The major drawback of this study was that each tutorial group's success was measured with one item, which was included in the same questionnaire as the one in which the dimensions were measured; thus, the measures might have been dependent on each other. However, the dimensions were used to refine the measurement property of a global judgement of the tutorial group's productivity or success, and

TABLE 1. Mean Ratings for Six Dimensions of Unsuccessful, Moderately Successful, and Highly Successful Tutorial Groups, Maastricht University, 1997–98*

Dimension	Unsuccessful Groups ($n = 10$)		Moderately Successful Groups ($n = 14$)		High Successful Groups ($n = 15$)		F	p
	Mean	(SD)	Mean	(SD)	Mean	(SD)		
Motivation	2.7	(0.5)	3.5	(0.5)	3.9	(0.4)	22.0	.000
Cohesion	3.3	(0.5)	3.6	(0.4)	3.7	(0.2)	5.0	.012
Sponging	2.8	(0.3)	2.3	(0.4)	2.0	(0.5)	12.4	.000
Withdrawing	3.0	(0.3)	2.6	(0.4)	2.2	(0.4)	12.9	.000
Interaction	2.8	(0.5)	3.3	(0.2)	3.6	(0.2)	22.8	.000
Elaboration	2.9	(0.4)	3.3	(0.2)	3.8	(0.3)	22.9	.000

*The ratings are expressed as mean ratings on a scale of 1–5 (1 = totally disagree to 5 = totally agree). Unsuccessful tutorial groups received productivity ratings lower than 6 on a scale of 1–10; moderately successful groups received ratings between 6 and 7; and highly successful groups received ratings higher than 7. In addition, the standard deviation (SD), the f value, and corresponding p value are given.

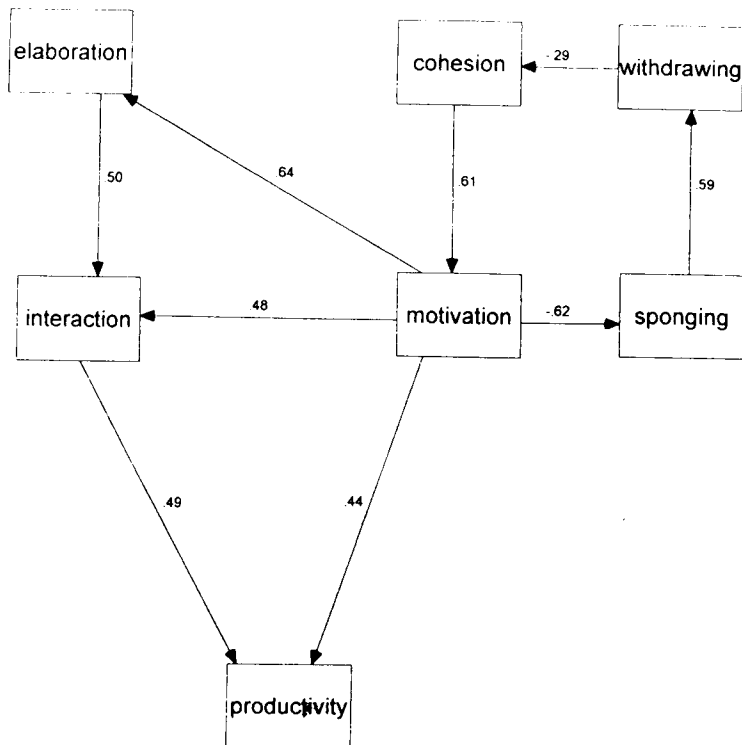


Figure 1. Linear structural model representing the influences of cognitive processes in tutorial groups (left part) and motivational processes (right part) on a tutorial group's success (expressed as its productivity). The values represent standardized regression weights and can be interpreted as the correlation coefficient between two dimensions. The number of tutorial groups included is 39. Maastricht University, 1997-98.

as such it is valuable to know which dimension had the most weight in predicting a tutorial group's success.

Furthermore, it was found that interaction and motivation directly influenced tutorial groups' productivity, whereas elaboration and cohesion had only indirect influences. Motivation played a central role, i.e., it directly influenced each group's success but it also influenced both cognitive processes. Although there is no reason to hesitate in concluding that interaction and motivation directly influence tutorial groups' success, the model should be cross-validated using another set of data collected within the same setting. In practice, other variables such as assessment tests, quality of problems, and tutors, along with cognitive and motivational processes, influence tutorial groups. These variables may differ from situation to situation. In a future study, the influences of other instructional variables on tutorial groups' success should be incorporated.

The findings that a tutorial group's success is strongly dependent on interaction (the degree to which students learn from one another) and the group's motivation imply that problems should be developed that stimulate students' motivation and provide much opportunity for interaction. In addition, tutors should be well trained in stimulating group interaction and in motivating students by encouraging a tutorial group's team spirit.

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