

Impact of Individual Study on Tutorial Group Discussion

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Background: This research focuses on the relation between individual study and group discussion. In a problem-based curriculum, it is expected that the way students prepare themselves during individual study (i.e., search and prepare the literature) will influence the quality of the reporting phase.

Purpose: To investigate whether searching for different literature resources and preparing the literature (by making summaries to explain the literature) affects the quality of the reporting phase.

Method: A 23-item questionnaire was developed, reflecting 2 factors of the search phase and 1 factor of the preparing phase of the individual study. Two factors (breadth and depth of the discussion) reflected the reporting phase. Participants were 1st-year students ($N = 195$, 90%) at the Medical School of the Maastricht University in the Netherlands during the academic year 1997–1998.

Results: Regression analyses show that the search phase and the preparing phase explained 29% of the variance of the breadth and 38% of the depth of the reporting phase.

Conclusions: Searching different literature resources has a small and negative impact on the quality of the reporting phase. However, preparing extensively for the next tutorial meeting is very important, especially for the depth of the reporting phase. Therefore, when new knowledge must be integrated in the tutorial group, students must be taught to prepare themselves by making summaries that are useful and effective during the discussion.

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A problem-based curriculum emphasizes the development of self-regulated learning skills. Therefore students should be actively involved, rather than be passive recipients of information.¹ The process of learning within a problem-based framework can be outlined as follows (see Figure 1). First, students are stimulated to discuss a problem in the tutorial group (phase 1). A problem consists of a description of a set of phenomena needing some kind of explanation.² However, during the discussion, some questions remain unanswered. These questions serve as learning issues (phase 2). Phases 3 and 4 are related to the students' individual study. Students actively search for literature that seems relevant regarding the learning issues (phase 3). Subsequently, students prepare the literature to explain their findings during the reporting phase to other students of the tutorial group (phase 4). Finally, in phase 5, when the group meets again in the reporting phase, students check whether the results of individual study enable them to understand and explain the problem.³ This study focuses on the learning processes in phases 3–5.

In the search phase, students are supposed to orient themselves on as many different learning resources as possible. This process of searching should be considered as a preparation of actual studying by means of inspecting the available resources like textbooks, the Internet, and journals. An assumption of a problem-based curriculum is that students must develop skills to manage differences or even contradictions in the literature. Moreover, in a tutorial group in which students do not consult a diversity of information in relation to the learning issues generated, exchange of different findings in literature during the reporting phase will not take place. Therefore, the discussion will be less broad and probably more shallow. A problem-based curriculum emphasizes that students learn to compare and search different resources during individual study. The extent to which students practice this process of consulting different resources is often seen as an indicator of self-directed learning. Rankin⁴ investigated whether students in a problem-based curriculum become self-directed learners. The study, which involved four medical schools (three problem-based

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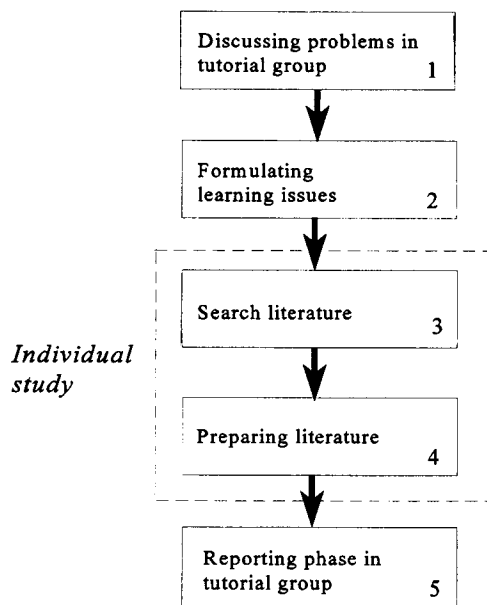


Figure 1. Components of the learning process problem-based learning.

and one conventional), found that students in a problem-based curriculum made greater use of the library and self-selected (as opposed to faculty-selected) reading materials and felt more competent in independent information-seeking skills. These findings are supported by other studies.⁵⁻⁸

During the process of searching, student-generated learning issues are assumed to play an important role.⁹ Dolmans and Schmidt¹⁰ explored to what extent student-generated learning issues influenced students' individual study and what other curriculum elements (i.e., a literature reference list, tests, and lectures) play a role in students' individual study. Based on the results of interviews and a questionnaire, Dolmans and Schmidt concluded that learning issues are the main starting point for students' individual study. However, 1st-year students also rely on other elements, such as literature reference lists and suggestions from the tutor. The influence of these elements tends to decrease over the 4 curriculum years, whereas the influence of the learning issues tends to increase. Therefore, students differ in the extent to which they are driven by learning issues.

Another aspect influencing the reporting in the tutorial group is related to the preparation of the literature to explain it to others. Research in small group learning shows that students will learn most when they give explanations.¹¹⁻¹³ According to Webb, the process of giving explanations may encourage students to clarify or reorganize knowledge, recognize and fill in gaps in knowledge, and construct elaborate conceptualizations.¹² In problem-based learning, students are expected to give explanations to each other and clarify the phenomena that underlie the problem. Students must prepare this during their individual study by questioning what is relevant in the text, making summaries, taking notes, translating the

literature into their own words, and making selections in the text. In other words, students engage in an explanation-oriented approach. Research shows that eliciting self-explanations facilitates the integration of new information into existing knowledge.¹³⁻¹⁵ For example, Chi and colleagues¹⁵ compared two groups of students. In the first group, students were asked to self-explain each line of a passage in a text. In the second group, students were only asked to read the text twice. The students who generated self-explanations learned with greater understanding than did the students who only read the text. These findings suggest that students who learn using an explanation-oriented approach will be better able to understand concepts and, therefore, will probably be better able to explain more different concepts with a deeper understanding.

Thus, the aim of this study is to shed light on the extent to which students' learning issues and the extensiveness of their search of the literature will positively affect the breadth and depth of the discussion in the tutorial group. It is assumed that an explanation-oriented preparation of the literature will increase the breadth and depth of the discussion of the tutorial group.

Method

Participants

Participants were all the 1st-year students ($N = 195$) at the Medical School of Maastricht University in the Netherlands during the academic year 1997-1998. One hundred and seventy-five students (90%), spread over 23 tutorial groups, responded. In each tutorial group, 9 students participated, and the number of students completing the questionnaire varied between 6 and 9 students per group.

Materials

A questionnaire was developed containing 23 items. Five factors were underlying these 23 items. Two factors referred to the search phase: *learning issue driven searching*, indicating the use of learning issues when searching learning resources, *extensiveness of searching*, suggesting the extent to which students searched and compared different learning resources. One factor referred to the preparation phase: *explanation-oriented*, indicating whether students studied the literature to explain the content to another student by writing summaries and notes. Two factors reflected the reporting phase: *breadth of reporting*, illustrating the extent to which a variety of literature resources were used during the reporting phase, and *depth of reporting*, indicating the extent to which the newly learned information was integrated. Five educational researchers with expertise in the field of problem-based learning and 12 first-year

students were asked to judge a draft version of the questionnaire. They were asked to judge whether each question reflected one of the factors. Students were asked to give their opinion on each item using a 5-point Likert scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The questionnaire items are shown in Table 1.

Procedure

Students were involved in a problem-based course called 'Attack and Defense,' which dealt with infection and the working of the immune system. After working on two tasks, students were asked to fill out the questionnaire individually (at home). They were instructed to give answers that reflected their studying during the previous 2 weeks.

Analyses

Data were aggregated at the tutorial group level by computing mean scores across students for each tutorial group (23 groups). The mean score of each tutorial group was the unit of analysis in all statistical procedures. To assess the construct validity of the factors, explorative factor analyses were conducted first. Subsequently, confirmatory factor analyses were per-

formed to investigate whether the model of five factors fitted the data.¹⁶ The three factors from the search and preparing phases were not significantly correlated. The factors in the reporting phase (breadth and depth) correlated significantly ($r = .66$; $p < 0.01$). The constraints, as defined by Saris and Stronkhorst,¹⁷ provide an indication whether the model fits the data: A chi-square value divided by the degrees of freedom lower than 3, a p -value larger than 0.00, an adjusted goodness-of-fit index larger than .80 and a root mean square residual lower than .07. The results showed a chi-square value of 249.3 ($df = 179$, $N = 23$), a p -value of $p < 0.001$, an adjusted goodness-of-fit index of .61, and a root mean square residual of .04. Two of four constraints were satisfied, such that the data were assumed to fit the factors reasonably.

To test reliability, Cronbach's alpha was calculated for each factor using the mean score of the variables of each tutorial group. The results show that the alpha of one factor was low, namely .53 (breadth of reporting). The alphas of the other factors varied between .64 and .80. To assess the extent to which the factors in the search phase and preparing phases explain the variance in the breadth and depth of the reporting, two univariate regression analyses were performed. The analyses were performed first with breadth of report-

Table 1. *Questionnaire Items for Search, Preparing, and Reporting Phase*

Search Phase	
Learning Issue Driven Searching (5 items)	
	When I start studying, I use the learning issues as a starting point to determine what literature I will search.
During studying	
	I always check the learning issues to determine whether I study deep enough.
	I'm particularly guided by the learning issues.
	I use learning issues to see if the literature I have studied covers the content.
	I use learning issues as a guideline to study the literature step-by-step.
Extensiveness of Searching (4 items)	
	When searching the literature, I try to judge different textbooks on their relevance for the subject to be studied.
	When searching the literature, I compare different literature about the same subject.
	I spent a lot of time and effort on searching the literature before I start studying.
	When searching the literature, I compare different literature about the same subject.
Preparing Phase	
Explanation Oriented (6 items)	
I prepare myself	
	such that I can explain the literature without the textbooks.
	such that I can clarify my point of view about theories.
	such that I can explain concepts in literature in my own words.
	such that I know what needs to be discussed in each learning issue.
	by making summaries of the literature.
	by making notes.
Reporting Phase	
Breadth of discussion (4 items)	
	Many different findings are discussed.
	When someone finds something that is not directly related to the learning issues, it is explained to others.
	The members of the group frequently question different aspects of the literature.
	Contrasting literature is explained.
Depth of Discussion (4 items)	
	During the discussion in the reporting, the new facts are explained and elaborated.
	The discussion in the reporting contains much depth.
	In using the newly learned knowledge, we question and clarify the phenomena that underlie the problem.
	The discussion in the reporting is very useful in addition to what I study.

ing as the dependent variable, and then with depth of reporting as dependent variable.

Results

The mean score of each factor is shown in Table 2. The factor with the lowest mean score is the extensiveness of searching learning resources ($M = 2.8$), and that with the highest score is depth of reporting ($M = 3.4$).

To determine the extent to which the independent variables explain the variance in each dependent variable (breadth and depth of reporting), two univariate regression analyses were performed; first with breadth of reporting as dependent variable, and then with depth of reporting. Results are presented in Table 3. It shows that 29% of the variance in breadth of reporting is explained by the factors in the search and preparing phases. The betas show that the contribution to the variance is almost equal for the three factors (successively .25, .27, .21). There were no significant contributions.

The lower part of Table 3 shows that 38% of the variance of depth of reporting is explained by the search and preparation phases. Explanation-oriented ($\beta = .53$) is the most important and significant factor. The extensiveness of searching reveals a negative influence ($\beta = -.15$).

Conclusions and Discussion

The question investigated was the degree to which students' self-reports of individual study in the search and preparing phases affected their perceptions of the breadth and depth of group discussions in the reporting phase. The breadth of the reporting phase is defined as the extent to which different findings or topics in literature are exchanged. In a problem-based curriculum, students conduct literature searches themselves. Not only do they learn to find necessary material independently, they also learn to manage, for example, contradictions in the literature. The results of this study show that when students search and compare different literature resources during their individual study, this will

positively stimulate the breadth of the reporting phase. However, the mean score on this factor (i.e., extensiveness of searching) is rather low ($M = 2.8$). This indicates that students did not extensively search and compare different literature. An explanation for this low mean score is that participants were 1st-year students. One may assume that advanced students, who are more experienced learners, might search for more varied learning resources. Advanced students have developed superior information-seeking skills, and it is likely that this will affect the breadth of the discussion. However, Cohen¹⁹ stated in a review article on small group learning that students who are experienced learners in collaborative work tend toward limited exchange of information and explanation. Cohen argued that an open and broad exchange and elaborated discussion are always necessary for optimal conceptual learning. Future research should focus on how students develop skills in searching literature during the years of training in a problem-based setting and whether this stimulates the breadth of the discussion.

The results of this study also show a trend that preparing the literature for the next tutorial meeting does affect the breadth of the reporting phase (although not significantly). When students prepare the literature with the aim of explaining it to someone else, the breadth of the discussion will also be stimulated.

Furthermore, the results show that when students in a tutorial group prepare themselves extensively for the next tutorial, the depth of the reporting phase will be affected. Preparation of the literature by creating summaries, and studying to explain the content to other students, seems crucial for stimulating deeper understanding of the findings. Previous research in small group learning shows that both deeper understanding and the construction of elaborated conceptualizations are promoted when students give and receive explanations during discussion. The findings of this study suggest that students who use an explanation-oriented approach to preparing will be better able to explain concepts to other students.

Conversely, when students search extensively for different literature, the reporting phase appears to be less deep (a nonsignificant trend). An explanation for this negative influence may be that when students in a tutorial group have found different literature, the discussion needs to be very well structured to reach a deeper understanding of the findings. Therefore, the discussion leader, who is a member of the group, has an important but difficult task to structure the discussion. Although students are trained to perform this role, it can sometimes be too difficult for 1st-year students with only limited experience to lead a discussion, and as a result the reporting phase will yield a less deep understanding. Another explanation could be that the level of expertise of the tutor influenced the quality of the reporting. However, all tutors are members of the

Table 2. Mean Scores on Factors, Standard Deviation, and Number of Groups

	<i>M</i>	<i>SD</i>	<i>N</i>
Search Phase			
Learning Issue Driven Searching	3.1	.3	23
Extensiveness of Searching	2.8	.4	23
Preparing Phase			
Explanation Oriented	3.2	.3	23
Reporting Phase			
Breadth of Discussion	3.0	.4	23
Depth of Discussion	3.4	.5	23

Table 3. Regression Weights (R^2 and β), the t Value and the F Value With the Factors in Preparing Phase and Search Phase as Independent Factors^a

	R^2	β	t	F
Dependent Variable: Breadth Search Phase				
Learning-Issue Driven		.25	1.01	
Extensiveness Searching		.27	1.22	
Preparing Phase	0.29			2.662
Explanation Oriented		.21	.79	
Dependent Variable: Depth Search Phase				
Learning Issue Driven		.18	.77	
Extensiveness Searching		-.15	-.62	
Preparing Phase	0.38			3.923*
Explanation Oriented		.53	2.08*	

^a $N = 23$.* $p < .05$.

faculty with comparable levels of expertise about the block content in question.

When students start individual study by searching literature with the learning issues generated, this seems to have a positive effect on both the breadth and depth of the reporting phase. Learning issues seem not only to serve as a main starting point for students' individual learning, but the learning issues also seem to structure and direct the discussion in the reporting phase.

In conclusion, the way students search and prepare the literature has an impact on the quality of the reporting phase. However, the most significant factor is the way students prepare the literature for the next tutorial meeting. In terms of educational practice, this finding implies that, not only must students learn to give explanations during the discussion, they must also be taught how to develop skills to prepare for this task during their individual study. For example, King²⁰ developed an inquiry-based approach to facilitate critical thinking and explaining based on individual and group learning by students. Students are taught how to ask questions using a model of inquiry and how to apply the model in cooperative-learning contexts in both individual learning and study settings. Eventually, students develop the skills to ask thoughtful questions of themselves and each other on what they read in their textbooks, hear in lectures, and encounter during discussions.

Finally, a limitation to this study is that all the measurements were student opinions. It would be an improvement if the dependent variable were measured independently of the independent variables. For example, instead of student opinion, trained observers could score the breadth and depth of the reporting phase.

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