Supporting Integrative Text and Picture Comprehension by Feedback

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Abstract. The high importance of joint comprehension of text and pictures in everyday life emphasises the need for teachers to provide instructional support for the development of their students' text-picture-integration skills. Integrating information from texts and pictures includes cognitive demands on multiple levels for the student. Teachers need to know about these demands and about the possibilities to adequately intervene into their pupils' processing, and they need specific diagnostic and didactic skills. In order to identify the diagnostic and didactic demands on the teacher level, a rational task analysis of the diagnostic and remedial requirements of helping students to deal with specific text-picture-integration tasks was carried out. The analysis focused in particular on which kind of feedback could be given at what time within the process of text-picture-comprehension. Results of this analysis will be presented and discussed within a theoretical framework for investigating cognitive and motivational aspects of feedback in the process of learning.

Introduction

Most texts we encounter in everyday life are texts with pictures. In school education, at least from the beginning of the fifth grade, pupils are confronted with texts that contain different types of pictures more and more often. Reading such texts requires complex processing of verbal and pictorial information in an integrative way. However, text-picture-comprehension is not systematically taught in school.

Theoretical Background

In order to support pupils' integrative text-picture-comprehension in an adequate way, teachers need to have specific diagnostic and didactic skills. More specifically, they should have sophisticated knowledge (a) about demands that processing texts with pictures poses on the cognitive system of the learner, (b) about the dynamics of learning processes and their implications on the cognitive, motivational, and emotional aspects of learning, and (c) about how these processes can be facilitated by the provision of feedback that takes these pivotal aspects of learning into account. With reference to the demands that the integrative comprehension of texts and pictures poses on the cognitive system of the learner (see a)), Schnotz and Bannert (2003) have proposed a model that describes the processing of verbal and pictorial information on different levels. In order to construct one coherent mental model of the subject, multiple referential linkages between pictorial and verbal information have to be established. On that basis, Schnotz, Horz, Ullrich, Baumert, McElvany & Schroeder (in press) showed that these referential linkages can be differentiated with reference to the complexity of the demands they pose on the cognitive system of the learner. In particular, the authors distinguished between three different levels of cognitive requirements. In general, to solve increasingly difficult tasks, one needs to process more and more facts and to complete more complicated operations.

However, in addition to knowledge about the demands that the integrative comprehension of texts and pictures poses on the cognitive system of the learner, teachers should also have sophisticated knowledge about the dynamics of learning processes in general, and of how and when these processes can be facilitated by feedback (see b)). With reference to the dynamics of learning processes, several theoretical models (e.g. Zimmerman, 2000; Heckhausen & Gollwitzer, 1987) postulate that learning is a cyclical, recursive process that proceeds in several phases (see Figure 1). According to Gollwitzer (1990), in each one of these phases the learners' attention is focused on specific information which helps him or her to meet the demands of the task. Hence, in our research, we assume that cognitive, affective and motivational aspects of learning in these different phases can be supported by specific feedback (see c)). In the forethought phase, goal-setting feedback can be provided that helps students to set adequate goals. Process feedback can be given during the performance phase in order to support task completion, whereas outcome feedback can be provided directly after the completion of the task in order to inform the student of the quality of his or her learning outcome.
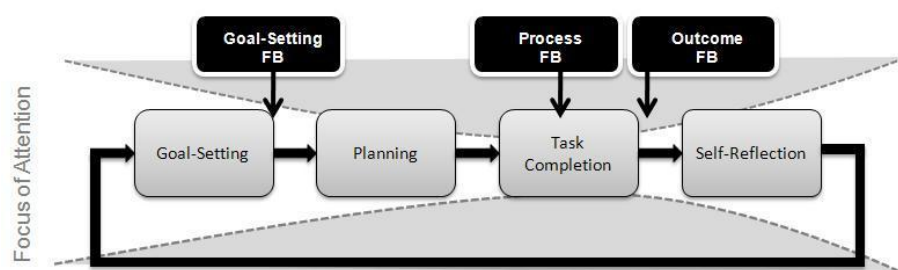

Figure 1: Learning phases and feedback types (derived from Gollwitzer, 1990; Zimmermann, 2000)

Research Questions

On this background, the subject of this study is to identify which kind of feedback could be given at what time within the process of text-picture-comprehension from a theoretical and empirical point of view. The answers to these questions are to be used to build a framework for further research within the project DIKOL ("Diagnostic and didactic competence of teachers", funded by the German Ministry of Education and Research within the Research Program: "Developing Teachers' Professional Skills"), in order to investigate to what extent teachers are able to promote the integrative comprehension of texts and pictures by providing adequate feedback.

Methods

The presented study is the first one of a series of projected studies within the research programme, and its methods are 1) a rational task analysis which was supplemented with a 2) deeper analysis of learning phases of pupils working on text and picture comprehension tasks in order to detect difficulties and kinds of mistakes that might occur. The results of these analyses are to be used to provide a basis for the categorisation and evaluation of feedback teachers provide in the main studies. In a first step, 85 pupils have been videotaped while completing text and picture comprehension tasks (four tasks each) and during phases of self-reflection and goal-setting. Each task required the comprehension of a text and the corresponding picture and answering six multiple choice questions which referred to the three different levels introduced above. The performance phase was followed by a self-reflection phase in which pupils were asked to evaluate the quality of their performance, and in

the goal-setting phase they could indicate whether the subsequent task should be less difficult, more difficult or equally difficult in relation to the one they had just solved. In addition, pupils were instructed to verbalise and/or to visualise the processes they were executing in order to complete the task. Out of all the videos, eight videotaped, clearly verbalised task completions of pupils have been selected and prepared as video-vignettes which will serve as stimuli for teachers that will participate in the subsequent main studies. In a second step, these video-vignettes have been analysed by means of low-inferent observation systems in order to detect difficulties and kinds of mistakes. Statements of pupils during phases of self-reflection and goal-setting have been transcribed.

Results

An overview of the results of the study is illustrated in table 1. With reference to different learning phases, it shows actions of pupils as exemplifying results from the empirical analysis of learning processes. As results from the rational task analysis, types of feedback which can be given by teachers are described in the column on the right. These are related to the pupils' actions and the demands and difficulties of tasks.

Table 1: Types and points in time of feedback.

Learning phases	Actions of pupils	Feedback of teachers
Goal-setting	Pupils choose tasks to complete next which are too easy, too difficult or appropriate to their previous performance.	Feedback on tasks which pupils selected to complete next with reference to the pupils' performances in previous tasks and to difficulties of tasks.
Planning	no consideration	
Task completion	Pupils find facts and associated information in the text and the picture, relate and process it (e.g. compare) in a correct or incorrect way (e.g. mistakes in assigning).	Support of operations which have to be completed (e.g. finding and relating information from text and picture); Advice in how to proceed in order to solve the task (e.g. recommendation to use learning strategies); Feedback on interim results and correct or incorrect completed operations
Self-reflection	Pupils reflect on their own achievement in the previous task (over-, under-, appropriate estimation).	Feedback on the shown performance with reference to normative, individual or social criteria of assessment; Feedback on self-reflection

Therefore, the results can provide a sound basis for the evaluation of feedback from teachers within the subsequent studies of the project and, in addition, recommendations for educational practice.

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