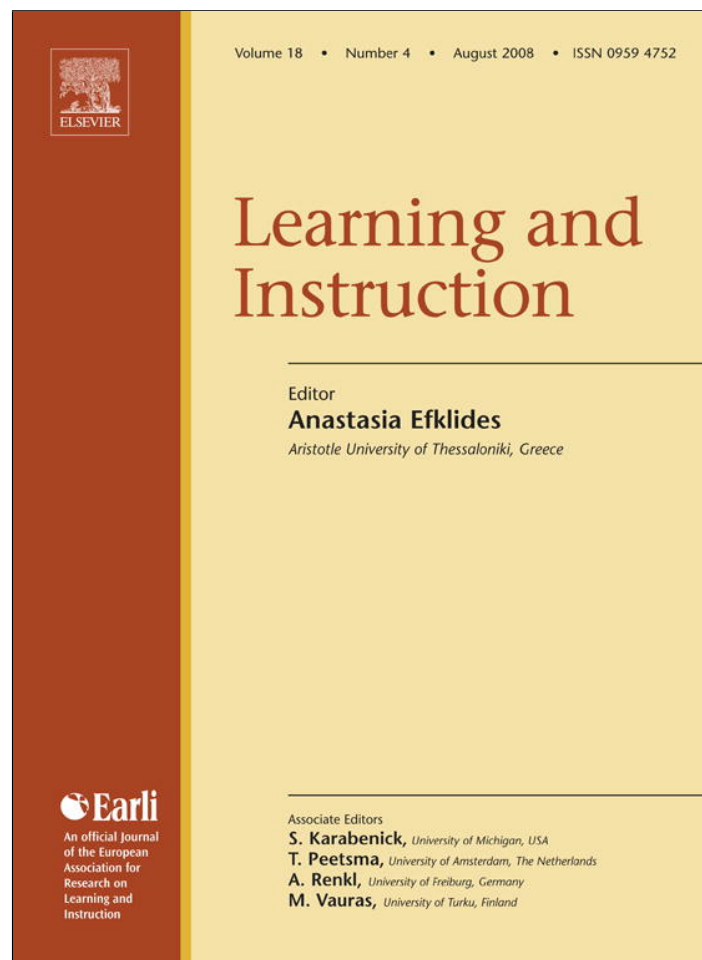


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# An aptitude–treatment interaction approach to writing-to-learn

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## Abstract

In this article, we propose to link the study of writing-to-learn to the theory of aptitude–treatment interaction (ATI). In an experimental study we examined the effects of a course on “Writing-to-learn about literary stories” consisting of writing tasks adapted to either a planning or a revising writing strategy. We hypothesized that the effects of writing-to-learn tasks depend on the interaction between students’ preferred writing strategy and the type of writing instruction, matching or mismatching students’ writing strategy. Our match hypothesis was in the main confirmed: results indicated that adapting writing tasks to students’ writing strategies increases their learning in the field of literature.

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*Keywords:* Aptitude–treatment interaction; Writing-to-learn; Writing strategies; Writing about literature; Secondary education

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## 1. Introduction

### 1.1. Writing strategy as moderator variable in writing-to-learn

Writing is a substantial and important part of students’ activities in upper secondary school education. Writing tasks in the classroom are often used as a way of exploring and making sense of new ideas; this is usually labelled writing-to-learn (Newell, 2006). The function of writing-to-learn is to order, interpret, or clarify learning experiences of all kinds in various school subjects (Tynjälä, Mason, & Lonka, 2001). However, review studies (Ackerman, 1993; Klein, 1999) have revealed that the relationship between writing and learning is complex and that the results of writing-to-learn studies are confusing: some have shown positive effects, others have reported no effect or mixed findings. In their meta-analysis about writing-to-learn, Bangert-Drowns, Hurley, and Wilkinson (2004) showed that positive effects are scarce and effect sizes are only small.

A reason for the lack of clear and consistent effects of writing-to-learn studies may be their focus on main effects, irrespective of students’ individual differences. Writing-to-learn studies have investigated the effects of one and the same intervention for all participants in a study. However, individual differences, especially concerning students’ preferred writing strategy, may be an important factor when applying writing-to-learn in various school subjects. Writing

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strategies may ease attentional overload while writing (Kellogg, 1988) and may consequently enhance learning from writing.

Including a moderator variable in intervention studies, that is, including any individual difference variable that may moderate the effects of a treatment on an outcome, was a major theme in the research paradigm of aptitude–treatment interaction (ATI). Cronbach and Snow's (1977) ATI theory states that optimal learning occurs when instruction matches the aptitudes of the learner. Here, aptitude stands for *any* individual difference variable that may moderate the effects of a treatment on an outcome (Cronbach, 1975). Snow (1989, 1992) specified this broad concept of aptitude, including not only cognitive abilities, but also conative and affective characteristics of learners.

Galbraith (1992, 1996, 1999) has conducted a productive research program studying one single moderator variable in writing: self-monitoring (Snyder, 1987). Galbraith (1992) reported consistent differences in the way high and low self-monitors develop their ideas in writing. He selected writers whose writing he assumed would be directed towards either rhetorical goals, that is, taking account of the reader's requirements, their knowledge, their opinions, and so on (high self-monitors), or dispositional goals, that is, spelling out spontaneously expressed thought (low self-monitors). These groups were then asked either to make notes in preparation for an essay or to write the draft text itself. The extent to which they developed new ideas as a function of writing in these different conditions was measured. Galbraith found a strong interaction between self-monitoring and mode of writing on the discovery of ideas, with high self-monitors discovering a large number of new ideas by making notes, but not by writing full text, and low self-monitors discovering a large number of new ideas after writing full text, but not after making notes. Based on this basic difference, Galbraith (1999) outlined a dual process model of writing suggesting that both dispositionally guided text production (as prioritised by low self-monitors) and rhetorical planning (as prioritised by high self-monitors) are necessary for effective writing.

## 1.2. Writing strategies

Studies in writing indicate that an important characteristic of students is their writing strategy, i.e., how they cope with the complexity of writing, by dividing a writing task into subtasks, sequencing these subtasks and regulating the attention paid to sub-processes (Torrance & Galbraith, 2006). A writing strategy is necessary for managing the complexity of a writing task. The two most well defined strategies (Galbraith & Torrance, 2004, p. 64) are (a) *planning strategy*, in which writers “concentrate on working out what they want to say before setting pen to paper, and only start to produce full text once they have worked out what they want to say” and (b) *revising strategy*, in which writers “work out what they want to say in the course of writing and content evolves over a series of drafts”. Torrance, Thomas, and Robinson (1994, 1999) offered consistent evidence of the planning strategy and the revising strategy in writing, when they analyzed students' questionnaire responses (1994) and students' logs of their writing processes (1999).

In the present study, we hypothesized that the effects of writing-to-learn will depend on the interaction between students' preferred writing strategy and the type of writing instruction. Offering students writing tasks that match their preferred writing tendencies may help to reduce the cognitive load of writing and may therefore have a positive impact on students' domain learning, because writing strategies (either planning or revising) allow planning the content of the text to be conducted free of the demands of constructing well-formed and coherent texts (Torrance & Galbraith, 2006).

However, one could also argue that students might benefit most if writing instruction helps to supplement and foster those strategies which students by themselves do not prefer, as was shown by Galbraith, Torrance, and Hallam (2006). They compared low and high self-monitors who wrote either rough drafts of spontaneous text or outline-planned text, and measured not just the amount of new ideas, but also the conceptual coherence of the ideas produced after writing. Low and high self-monitors showed increases in conceptual coherence under opposite to their preferred strategy conditions. Low self-monitors experienced increases in conceptual coherence after writing outline-planned texts but decreases in conceptual coherence after writing rough drafts. In contrast, high self-monitors experienced increases in conceptual coherence after writing rough drafts, but decreases in conceptual coherence after writing outline-planned texts. Thus, in the present study we tested two concurrent moderator variable hypotheses: a match hypothesis, derived from ATI theory (instruction should match the student's writing preferences) and a compensatory hypothesis (derived from Galbraith's dual processing theory suggesting a compensatory instructional approach). We tested these alternatives in the domain of literature education, where writing-to-learn is quite popular.

### 1.3. *Writing-to-learn about short literary stories*

In school practice, the subject of literature generally consists of reading and discussing literary texts, and various actions related to reading these texts — very often writing about reading experiences. It seems that literature teachers and textbook writers are convinced that writing supports students' understanding of literature (Marshall, 1990; Purves, 1991). However, the role of writing in learning literature was rather under-studied in research about writing-to-learn (e.g., Bangert-Drowns et al., 2004). A few studies (Boscolo & Carotti, 2003; Marshall, 1987; Newell, 1996; Newell, Suszynski, & Weingart, 1989; Wong, Kuperis, Jamieson, Keller, & Cull-Hewitt, 2002) have offered some empirical evidence that writing can be an effective learning activity in the literary classroom and that writing increased students' literary understanding. However, the "adaptation to learners' aptitudes paradigm" was not taken into consideration in these studies.

### 1.4. *Prior studies*

The present study builds on a prior study reported in Kieft, Rijlaarsdam, and Van den Bergh (2006), in which a writing course "Learning to write argumentative texts about literary stories" was developed. In each unit, students independently worked on learning to write an argumentative text about a short literary story. In all the writing assignments of the course, idea generation and composition were separate one from another. Our assumption, based on the work of Galbraith (1992), was that students with a planning preference (in Galbraith's study: writers who experienced writing as a process of achieving goals) differ from students with a revising preference (in Galbraith's study: students who experienced writing as a discovery process) not only in the way they compose but also in the way they generate ideas. Therefore, we created two different versions of the course, based on either a planning writing strategy or a revising writing strategy. In the Kieft et al. (2006) study, the lesson series were implemented in five Grade 10 classes. Results showed that for improving literary interpretation skill the course adapted to planning writing strategy was more effective for almost all students. In another study, the effect of the course was tested not in the domain of literary interpretation skill but on writing skill itself (Kieft, Rijlaarsdam, Galbraith, & Van den Bergh, *in press*). Results showed that the effects of the planning condition depended on the level of students' planning or revising strategy: the more students preferred a planning or a revising strategy, the larger the effect on writing skill. In contrast, the effect of instruction based on a revising writing strategy did not interact with the level of planning or revising strategy: there was no relationship between the revising condition and the writing strategy. Thus, the results of the previous study were somewhat inconsistent: they corresponded neither to a match nor to a compensatory hypothesis. Therefore, we designed the present experiment to clarify these results. We improved the course, the method and the testing materials, and tested two alternative hypotheses, while focusing on writing-to-learn about literature.

### 1.5. *The present study*

The course "Writing argumentative texts about short stories" consisted of five units of 90 min in which students wrote argumentative texts about short literary stories. We considered an argumentative text as a contribution to a discussion, as is rather common in Dutch language education (cf. Van Eemeren & Grootendorst, 1992). We chose literary interpretation skill as a learning outcome of the course, as in other studies aimed at writing-to-learn about literature (e.g., Boscolo & Carotti, 2003; Marshall, 1987; Newell, 1996; Newell et al., 1989; Wong et al., 2002).

To test the moderator variable hypothesis, we created two versions of the course, one based on a planning writing strategy (planning condition), and one based on a revising writing strategy (revising condition). Both versions provided guidance in discovery (idea generation) and in text production. The planning condition guided students to plan their texts with a planning scheme, and invited students to critically review and reread their planning schemes. The writing tasks in the phase of idea generation invited students to generate ideas in a planning way: by putting down short notes instead of writing full text. The revising condition invited students to revise their texts and stimulated them to critically reread and review their first drafts. The generation of ideas was generation in a revising way, by the free writing of full text and distilling useful ideas from it for writing the argumentative text (cf. Galbraith, 1992).

In this study, we tested two concurrent hypotheses: a match hypothesis and a compensatory hypothesis. The match hypothesis was (a) the more students tend to use a revising writing strategy, the more they profit from the revising condition and the less they profit from the planning condition and (b) the more students tend to use a planning writing

strategy, the more they profit from the planning condition and the less they profit from the revising condition. The compensatory hypothesis was (a) the more students tend to use a revising writing strategy, the less they profit from the revising condition and the more they profit from the planning condition and (b) the more students tend to use a planning writing strategy, the less they profit from the planning condition and the more they profit from the revising condition.

## 2. Method

### 2.1. Participants

The experiment took place at three different high schools in three different regions of the Netherlands. The study was part of the regular schedule of eight Grade 10 classes; 220 students were involved. In Grade 10, students' prior knowledge of writing argumentative texts about literature is limited: in the Netherlands, students do not start to read adult literature until this grade. Usually, students have more experience in writing argumentative texts; they start learning to write argumentative texts in lower secondary education. At the end of the Grade 9, they know that an argumentative text aims at convincing the audience by introducing a standpoint supported by arguments. The issues that students generally have to write about, in so called functional texts, cover subjects such as after-school jobs, smoking, having exotic animals as pets – but usually do not include literature (Kieft & Rijlaarsdam, 2002).

### 2.2. Design

We set up an experimental study with a pretest and posttest design with random assignment to conditions. We measured students' literary interpretation skill and their levels of planning and revising writing strategy before and after the intervention.

The lesson materials of the course were completely self-instructing. During the course, the teacher's role was to coach students while working. Within the classrooms, both conditions were implemented and students were randomly assigned to the conditions. This design implied that all participating teachers ( $N = 8$ ) were involved in teaching both conditions, thus avoiding teacher effects. Therefore, possible differences in the way teachers implemented the lessons and possible differences between classrooms did not threaten the validity of the research design.

### 2.3. Procedure

The course was a slightly adapted version of the course used in Kieft et al. (2006). Based on the experiences of the five participating teachers and the lesson observations by the first author, we improved the course in some respects. The main improvements were (a) more variety in the discovery writing tasks; (b) better fit with time constraints, therefore some assignments were deleted; and (c) replacement of one of the stories that students apparently not appreciated.

The field for discussion was literature. Students read a short literary story and learnt to generate an issue, such as "Is this story too old-fashioned for today's students?", for discussion in their text. Furthermore, students learnt to present a standpoint, to generate, select and arrange arguments to support their point of view on the issue, and to integrate these elements in a rhetorically attractive text.

Table 1 shows the six phases in each unit of the course. The first phase consisted of reading a literary short story; the same story in both conditions. The stories were unfamiliar to the students and sufficiently challenging (according to the teachers). The stories varied in tone, strategy and structure; the complexity of the stories increased throughout the lessons. The second phase was the phase of discovery. In the revising condition, students discovered ideas by writing fully unstructured text, for example by "free writing" (Elbow, 1973). Students wrote down their perceptions, feelings, memories, reactions and responses to the story, while writing continuously, trying to avoid stopping. In the planning condition, students discovered their ideas by filling in note-forms, for example by filling in a "thinking scheme", in which they wrote down their thoughts in a few words (Skeans, 2000). We based this choice of assignments (free writing versus thinking scheme) on the work of Galbraith (1992).

In the third phase, in both conditions students read short theoretical information about aspects of the argumentative text genre (shown in Table 2) and carried out one or two exercises to apply the theory.

Table 1  
Overview of the learning activities in both conditions

Main phases	Learning activities	Revising condition	Planning condition
1. Reading	Reading a literary story	+	+
2. Discovery	Generating ideas		
	Free writing	+	–
3. Theory	Thinking scheme	–	+
	Reading rhetorical theory	+	+
4. Planning content	Applying theory in short writing tasks	+	+
	Writing discovery draft of the text	+	–
5. Composing	Create a planning scheme	–	+
	Critical rereading and writing a second draft	+	–
6. Sharing	Revising planning scheme and write the text	–	+
	Sharing texts: giving and receiving feedback	+	+

+ = present; – = not present.

The fourth phase was devoted to planning content. In the planning condition, students planned the content of their text by thinking about the aim, audience, and content of the text and filling in a planning scheme. In the revising condition, students wrote a ‘discovery’ draft. Composing a discovery draft is a way of developing content in writer-based prose; revising the first draft provided an opportunity to develop this text into reader-based prose, improving rhetorical and argumentative aspects (Galbraith & Torrance, 2004).

In the fifth phase, the composing phase, the students in the planning condition had to reread, evaluate and revise the planning scheme and to write their texts. The students in the revising condition reread, evaluated, and revised their first draft, using the same criteria as in the planning condition, namely quality of argumentation and rhetorical quality and wrote the text. In the sixth phase, in both conditions students read and commented on each other’s text.

#### 2.4. Instruments

A questionnaire of 26 items measured students’ *planning and revising writing strategies* in the pretest and posttest. Kieft et al. (2006) tested the questionnaire in a previous study. In the present study, we extended the questionnaire items for the planning scale and we improved the operationalization of the revising scale (see also Kieft et al., in press). Table 3 shows the questionnaire items. Students rated how much they agreed with each item on a five-point scale. The questionnaire consisted of 11 planning items and 15 revising items; Cronbach’s alphas for these two scales were 0.75 and 0.73, respectively. Because reliability was sufficient, we aggregated planning items and revising items and computed a mean planning score and a mean revising score for each student. This procedure resulted in two continuous aptitude variables: students’ level of planning writing strategy and students’ level of revising writing strategy. A small but significant correlation was observed between the planning writing strategy and the revising strategy,  $r = 0.34$ ,  $p < 0.001$ . This correlation validated our decision to distinguish between planning and revising strategies instead of considering them to complement each other.

Table 2  
Distribution of cumulated learning contents over five instructional units

Learning content	Unit				
	1	2	3	4	5
To define and formulate the issue	+	+	+	+	+
To form and base an opinion on the issue	+	+	+	+	+
To introduce and to conclude		+	+	+	+
To inform		+	+	+	+
To quote			+	+	+
To argue				+	+
To signal argumentation				+	+

+ = present.

Table 3

The items of the questionnaire on planning and revising strategies in writing along with item-total correlations

	Item-total correlation
Revising items	
Before I hand in my text, I check whether it is structured logically	0.45
*I don't pay much attention to whether I'm satisfied with my text myself	0.42
Writing helps me to clarify my thoughts	0.41
When I write a text, I question myself from time to time whether the text is comprehensible for my readers	0.38
*When I write a text, I find it difficult to form ideas about which I can write	0.37
Before I start to write a text, I prefer to write down some thoughts on a scribbling paper to discover what I think about the topic	0.36
While writing, I regularly check whether my text doesn't contain sentences that are too long or incorrect	0.35
*I don't pay much attention to skipping sentences or thoughts	0.33
When I reread and rewrite my text, the structure of the text may change a lot	0.33
When I rewrite my texts, the content often changes a lot	0.30
*I usually hand in my text without checking whether the paragraphs are well arranged	0.29
When I have finished writing, I reread and improve a lot: this may change a lot in my text	0.28
I have to reread the texts I wrote, to prevent redundancies	0.26
*Usually, the texts I write are not very creative	0.20
When I know what to write globally, I write my texts very easily	0.18
Planning items	
*Planning a text is not useful for me	0.58
*When I start writing, I don't know what the content of the text will be	0.53
When I write a text, I spend a lot of time thinking on how to approach it	0.50
Before I start to write, it is clear for me what I want to achieve with my readers	0.45
Before writing a text, I jot down some notes on a scribbling paper. Later, I elaborate these notes	0.41
I always use a diagram before I start to write	0.39
Before I start to write, I have to know what the content of the text will be. Therefore, planning is important for my writing	0.35
I need to have my thoughts clear, before I can start to write	0.34
*When writing, I sometimes write paragraphs of which I know that they are not yet correct, but I prefer to continue writing	0.33
When I reread my texts, sometimes they are very chaotic	0.27
Before I write down a sentence, I have it clear in my mind	0.23

Starred items (\*) were recoded in the analyses. The more the students agree with the items (on a five-point scale), the higher the scores.

To measure *literary interpretation skill*, we implemented a pretest and a posttest, based on the prior study (Kieft et al., 2006). Participants wrote a short text after having received the following instructions: "You are about to read a short story. Write a text about the story of at least 250 words, in which you tell a classmate what the story is about, and what your opinion about the story is." To avoid a story effect, four different stories were included in a complete balanced design. First, we determined all possible combinations of stories for pretest and posttest. Next, all participants were randomly assigned to a combination of stories (for example, Student 1 received Story A for the pretest and Story B for the posttest; Student 2 received Story B for the pretest and Story C for the posttest).

For the raters, the pretest and posttest texts in the set were completely mixed. Three raters received training to score the texts holistically for the quality of literary interpretation, the level to which students showed to have understood the story, and *not* on text quality (for example, the quality of argumentation or rhetorical attractiveness). Each text was scored on a scale from 0 to 5 by the individually working three raters, using anchor texts that illustrated each score from 0 to 5. We demonstrate the coding with an example of one of the stories (Appendix A), and the scale used by the raters for this story (Table 4). The three independently working raters formed a homogeneous set (reliability analysis conducted with the raters as items resulted in Cronbach's alpha 0.83 and 0.89 for the pretest and the posttest, respectively). This allowed us to use the mean score of the three raters as students' pretest score and posttest score.

Finally, we measured students' *evaluation of the lesson units*, to check whether a difference in appreciation of the lessons would have affected the effect of the conditions. We collected participants' evaluation of the specific revising and planning tasks of the lessons by asking students to indicate their appreciation on a five-point scale with scores from 1 = "I did not find this task useful" to 5 = "I did find this task useful". Cronbach's alpha for the evaluation questionnaire (20 items) was 0.72.

Table 4  
Example of the criteria for rating the interpretation of the story “Hullay”

Criteria	Score
• Student retells the story, without any interpretation; or student tries to interpret, but shows not to understand the story at all.	1
• Student does not recognize the crux of the story (i.e., boy sees his cousin Arthur drowning, but does not do anything to help him), but shows minor interesting or insightful thoughts, like: “The boy describes the persons present at the birthday party by their scents”.	2
• Student recognizes the crux of the story, but does not provide any explanation; or student provides an implausible explanation or an explanation without any support. For example: “It is not normal to do nothing when you see someone drowning in the pond. Probably the boy is mad.”	3
• Student recognizes the crux of the story, provides a plausible explanation with specific support from the text, for example by citing quotes from the story. For example: “I think the boy is jealous, because the grandfather says that Arthur is much smaller, but more energetic than the boy”.	4
• Student recognizes the crux of the story, provides specific text support and also offers additional interesting or insightful thoughts, like an explanation for the puzzling title of the story or an explanation for the nightmares the story refers to.	5

## 2.5. Analyses

The research question pertained to the effect of a moderator variable (i.e., writing strategy) on an outcome variable (literary interpretation skill of students), in two conditions. That is, we intended to show that the relationship between literary interpretation skill and writing strategy varies between conditions. Therefore, we defined a dummy variable, say  $D\_PC_i$ , which is turned on (equals 1) if a student was allocated to the planning condition, and turned off (equals 0) if a student was allocated to the revising condition. Now, the score in both conditions can be written as a function of the planning score ( $PS_i$ ) of student  $i$ . More formally, the equation depicting the model (Eq. (1)) is as follows (conforming Aiken & West, 1991):

$$Y_i = \beta_0 + \beta_1 \times PS_i + D\_PC_i(\beta_2 + \beta_3 \times PS_i) + e_i \quad i = 1, 2, \dots, n \quad (1)$$

The model in Eq. (1) shows that the intercept of both conditions is allowed to vary. In the revising condition, the intercept is  $\beta_0$  (constant), whereas in the planning condition the intercept equals  $(\beta_0 + \beta_2)$ . This difference (the main effect) between conditions is directly tested by the significance of  $\beta_2$ .

The slopes of the regression lines are allowed to differ between conditions as well. In the revising condition ( $\beta_1 \times PS_i$ ) gives the slope of the regression line. In the planning condition the slope of the regression line equals  $(\beta_2 + \beta_3 \times PS_i)$ . The differences in slopes are directly tested by the significance of  $\beta_3$ .

The covariate, namely the pretest score on literary interpretation ( $P\_LI_i$ ), should be incorporated in the model. The same holds for the revision scores ( $RS_i$ ) of student  $i$ . The final model as used in the analyses was as follows (Eq. (2)):

$$Y_i = \beta_0 + \beta_1 \times RS_i + \beta_2 \times PS_i + D\_PC_i(\beta_3 + \beta_4 \times RS_i + \beta_5 \times PS_i) + \beta_6 \times P\_LI_i + e_i \quad i = 1, 2, \dots, n \quad (2)$$

Leaving aside the influence of the literary interpretation pretest scores ( $\beta_6$ ), the difference in regression lines between the revision condition and the planning condition can be tested as the regression line for the planning condition, written as a deviation from the revising condition. Thus, for revising scores, the slope for the revision condition is  $\beta_1$ , and the slope for the planning condition  $\beta_1 + \beta_4$ ; for planning scores the slope is  $\beta_2$  in the revising condition and the slope is  $\beta_2 + \beta_5$  in the planning condition (see Table 5).

## 3. Results

### 3.1. Preliminary analyses

To investigate the hypotheses, a prerequisite was that students would dedicate sufficient effort to the learning condition that they were assigned to. Therefore, we narrowed down the selection of participants for the study using two criteria. First, we selected participants who had attended all the lessons and all the test sessions (pretest, posttest, writing questionnaire). Second, from this set, we selected students who completed all assignments and clearly put in reasonable effort in the study, as indicated by assignment ratings. Two independently working coders scored all students'

Table 5  
Regression estimates for the aptitude–treatment interactions in Eq. (2)

Parameter	Description	Estimate	
		$\beta$	SE
$\beta_0$	Intercept of RC	−0.08	0.12
$\beta_3 \times D\_PC$	Difference in intercept between PC and RC	−0.17	0.18
$\beta_2 \times PS$	Effect of planning score in RC	−0.32 <sup>+</sup>	0.13
$\beta_5 \times PS \times D\_PC$	Additive effect of planning score in PC compared to RC	0.30 <sup>+</sup>	0.14
$\beta_1 \times RS$	Effect of revision score in RC	0.41 <sup>+</sup>	0.18
$\beta_4 \times RS \times D\_PC$	Additive effect of revision score in PC compared to RC	0.62 <sup>+</sup>	0.22
$\beta_6 \times P\_LI$	Covariate: effect of pretest	0.28 <sup>+</sup>	0.09

RC = revision condition; PC = planning condition; PS = planning score; RS = revision score.

Significant estimates are shown with <sup>+</sup> if absolute  $\beta$  values divided by their standard errors (SE) exceed 1.965;  $p < 0.05$ .

work by rating the quality of 11 key assignments in their work books on a three-point scale from 0 = “not performed at all” to 3 = “performed perfectly”. These 11 key assignments were the distinctive assignments between the two conditions, out of a total of 36 ( $M = 26.85$ ,  $SD = 5.10$ , the maximum score that could be obtained was 33). Cronbach’s alpha over items was 0.79. Intercoder reliability was satisfactory ( $r = 0.91$ ). Those students who completed all assignments and clearly put in reasonable effort in the study (with a score of 25 or higher on the quality of workbooks) were selected. This selection procedure resulted in almost equal participants in the revising ( $n = 57$ ) and the planning ( $n = 56$ ) condition. Aptitude scores and writing strategy scores of both the group of selected and nonselected students were similar: for aptitude scores,  $t(146) = -0.28$ ,  $p = 0.78$ ; for planning writing strategy,  $t(117) = -0.73$ ,  $p = 0.64$ ; for revising writing strategy,  $t(117) = 1.03$ ,  $p = 0.31$ .

We analyzed the results of the writing questionnaire measuring students’ level of planning strategy and level of revising writing strategy. We found that writing strategy was a rather stable characteristic of students (correlations between pretest and posttest: for planning strategy,  $r = 0.55$ ,  $p < 0.001$ , and for revising strategy,  $r = 0.53$ ,  $p < 0.001$ ).

We tested possible differences between conditions regarding evaluation of lessons. It was shown that groups appreciated both conditions equally:  $t(111) = -0.56$ ,  $p = 0.58$  ( $M = 3.34$ ,  $SD = 0.50$  in planning condition, and  $M = 3.29$ ,  $SD = 0.56$  in revising condition).

Furthermore, there was a small but significant correlation between pretest and posttest on literary interpretation skill,  $r = 0.20$ ,  $p = 0.03$ .

### 3.2. Main analyses: results for revising strategy

As already mentioned, two hypotheses were formulated: a match hypothesis and a compensatory hypothesis. For the revising writing strategy, the match hypothesis was confirmed (in Fig. 1 a visual representation of the results is given). The regression slope of the revising condition shows that the higher the scores on revising writing strategy, the higher the score on literary interpretation skill in the adapted condition: the revising condition,  $\beta_1 = 0.41$ ,  $p = 0.03$  (see Table 6 and Fig. 1). The alternative hypothesis, namely the compensatory hypothesis, stating that students with a high tendency to revising are better off with a planning condition, must be rejected: the regression slope of revising scores in the planning condition differs significantly from the slope in the revising condition,  $\beta_4 = -0.62$ ,  $p = 0.005$ . Hence, in the planning condition the slope for the regression of revision scores equals  $-0.21$  ( $0.41 - 0.62$ ), which is significant,  $t = -2.01$ ,  $p = 0.047$ .

### 3.3. Main analyses: results for planning strategy

Our match hypothesis with planning writing strategy as aptitude was partly confirmed (see Fig. 2). The regression slope of the revision condition is negative,  $\beta_2 = -0.32$ ,  $p = 0.01$ ; the higher students’ planning scores, the lower their literary interpretation score. The alternative compensatory hypothesis for planning writing strategy was not confirmed: in the planning condition, the relation with planning scores differs from the one in the revision condition,  $\beta_4 = 0.30$ ,  $p = 0.04$ . Therefore, the net slope of the regression line in the planning condition equals  $-0.02$

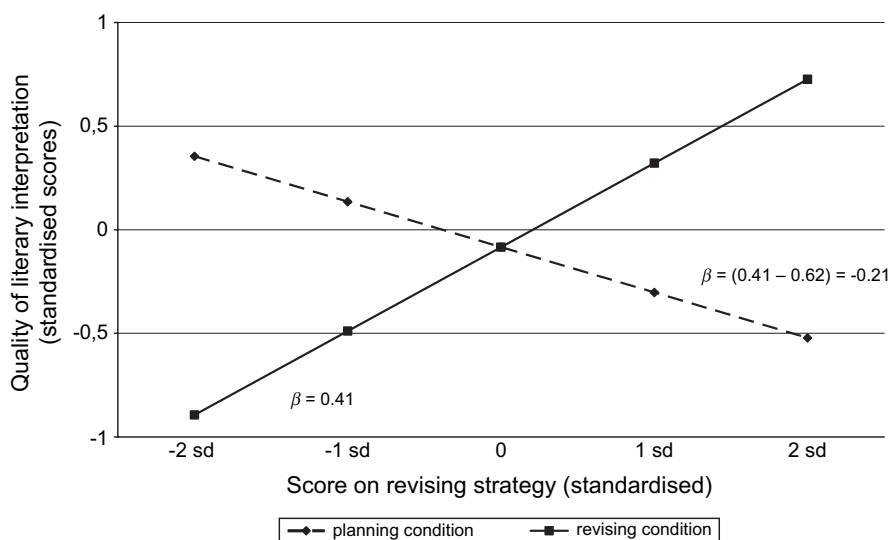


Fig. 1. Regression slopes for effects of interaction between condition and revising writing strategy on literary interpretation skill.

( $-0.32 + 0.30$ ), which is not significant,  $t = -0.11, p = 0.91$ , indicating the absence of an effect of the moderator variable planning writing strategy in the planning condition (see Table 6 and Fig. 2).

In conclusion, in three out of four cases, the match hypothesis was confirmed: students learn more by writing when they write in a condition that fits their writing strategy.

#### 4. Discussion

This study examined the effects of writing instruction adapted to different writing strategies on learning to interpret literature. We anticipated an interaction effect between condition and writing strategy on literary interpretation skill, because the treatments capitalized on strengths as advocated by the ATI paradigm. Our match hypothesis was mainly confirmed. For students with high scores on revising strategy the revising condition is the best choice, while for students with low scores on revising strategy, the planning condition is recommended. Students with low scores on planning strategy are better off in the revising condition. The horizontal regression slope indicated the absence of a correlation between planning writing strategy and literary interpretation skills in the planning condition (see Fig. 2).

How can one explain this absence of correlation between planning strategy and literary interpretation skill in the planning condition? It is possible that students who reported a high planning strategy on the writing questionnaire were students who thought that it is appropriate to plan because this was what they were taught to do: when writing strategy is addressed in writing education in The Netherlands, it usually includes directions to plan before writing full text. Therefore, high scores on the planning strategy may indicate a level of social desirability for some students. Possibly, the planning writing scale is not as valid as we wish.

A possible invalidity of the planning scale may be supported by the scores on the evaluation of lessons questionnaire. Regression analysis with evaluation of lessons as dependent variable showed that the higher students scored on

Table 6  
Means and standard deviations of writing strategies and literary interpretation skill in pretest and posttest

	Pretest				Posttest			
	Revising condition		Planning condition		Revising condition		Planning condition	
	M	SD	M	SD	M	SD	M	SD
Revising writing strategy	3.20	0.35	3.09	0.55	3.00	0.45	3.00	0.40
Planning writing strategy	2.88	0.63	3.00	0.53	2.80	0.52	2.96	0.43
Literary interpretation skill	2.01	0.74	2.29	0.93	2.18	1.01	2.14	0.91

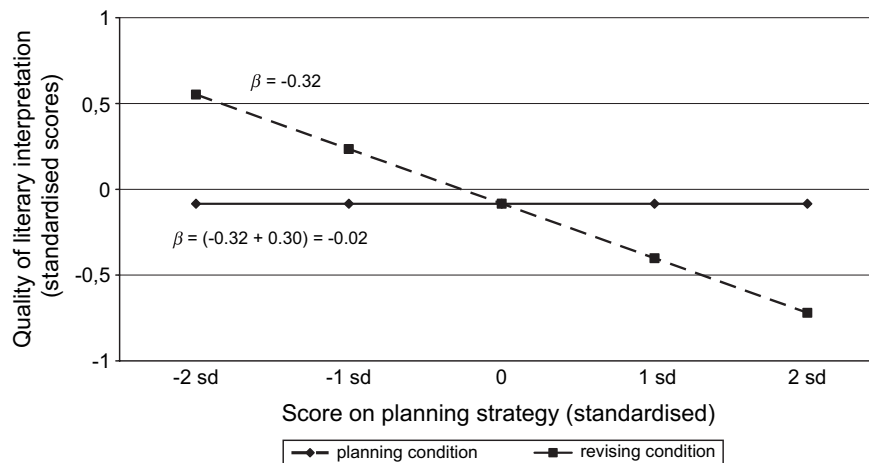


Fig. 2. Regression slopes for effects of interaction between condition and planning writing strategy on literary interpretation skill.

planning writing strategy, the more they appreciated the revising condition, both the phase of idea generation,  $\beta = 0.32$ ,  $p = 0.02$ , and the phase of text composition,  $\beta = 0.47$ ,  $p < 0.001$ . This shows that the higher students scored on planning writing strategy, the more they appreciated both the phase of idea generation and the phase of text composition in the *revising condition*. This may indicate that students with a high score on planning in fact did not have a natural preference for planning but, instead, they scored high on the planning scale for other (unknown) reasons, possibly because they had been taught to plan before writing. On the other hand, they may have experienced the revising course as eye-opener, which shows that it is possible to write in a revising way, and consequently they highly appreciated the revising condition. However, this did not result in better results in the revising condition: the planning condition was still relatively speaking the best choice for the high planners.

The selection procedure for including students in the data analysis could be a threat to the external validity of the experiment and the results found. However, there are indications for a good external validity, because the participants were from different parts of the country and from different schools, and taught by different teachers. Of course, one could question the validity of a self-reporting questionnaire for measuring writing strategies, because response biases and difficulties in recalling how to approach a writing task will inevitably cause errors in retrospective estimates of writing strategies. Therefore, we did not interpret the absolute values of students' scores on the questionnaire, but chose to use the writing questionnaire scores only to measure individual differences between students. However, we have three indications that our questionnaire was an instrument of sufficient validity. First, our data showed (cf. Torrance et al., 1994) that self-reports of the writing process detected successfully relevant differences between students. Second, the correlation between writing strategy measured during pretest and posttest 5 weeks later ( $r = 0.55$  for planning strategy and  $r = 0.53$  for revising strategy) indicated a certain stability over time, that is, test–retest reliability of the questionnaire. Nevertheless, validation studies are welcome. Gathering writing process data, for example by using a digital tool such as *Inputlog* (Leijten & Van Waes, 2005), besides self-report data, could ensure the validity of our writing strategy inventory.

It may be the case that the writing questionnaire we used to operationalize the variable writing strategy did not measure writing strategy, but rather something like writing preference. Even if this is the case, we still think the ATI we found is useful for education, because according to Snow (1992) affective characteristics of students ought to be examined as relevant to important instructional goals as well.

At first sight, another limitation of the present study seemed to be the lack of reasonable correlation between pretest and posttest on literary interpretation ( $r = 0.20$ ). However, it should be noted that reading literary stories, and writing about them, were completely new tasks for the participants in this study. Hence, the pretest could not really measure students' skill yet, because it was the first time they performed such a task. This may have restricted the strength of the correlation.

Compared with the Kieft et al. (2006) study, in the present study we found different effects. In Kieft et al. (2006) study, we had found that the planning condition was generally the best condition for all students, especially for the students with a high revising strategy. Thus, the two studies show different results. Cronbach (1975) also reported

that ATI research found inconsistent results, with same treatment variables resulting in different “outcome-on-aptitude slopes”. He surmised that the inconsistency came from unidentified interactions. The Kieft et al. (2006) study and the present study differed in several aspects, possibly explaining the different results. In the present study, compared to the Kieft et al. (2006) study, (a) more schools participated, (b) more and different teachers and classes participated, and (c) only students who invested sufficient effort to the lessons were selected<sup>1</sup> for participating in the study. These issues may not only explain the differences in results but, at the same time, they are the reason why we consider the results of the present study to be more valid.

The results of this study may have implications for the use of writing as a learning activity in the literature curriculum in secondary education. In Dutch literature textbooks, most writing tasks are just assignments without any instruction on how to carry them out (Kieft & Rijlaarsdam, 2002). The present study provided support for an educational practice of assigning writing-to-learn tasks, which (a) show students how to write a specific genre and (b) are adapted to different writing strategies.

Finally, although writing is very frequently used in literature education, we would like to emphasize that in our view, writing is not *the* most effective remedy for learning to interpret literary stories. This study is not a plea to add more writing tasks in the literature classroom. It is possible that other learning activities, for example discussion about books, are more effective. However, when teachers do insist on writing (book reports, essays, reviews), we can recommend that they take into account students' writing strategies and vary the writing assignments and procedural steps according to these writing strategies. Offering students different possibilities for the generation of ideas to write about, and offering them different paths leading to an argumentative text, may be valuable in writing education in upper secondary education.

In sum, our results indicate that reintroducing the concept of aptitude–treatment interaction may be a valuable contribution to the practice and research of writing-to-learn.

## Appendix A. Short description of one of the stories used in pretest and posttest

The main character of *Hullay* is a boy who visits his aunt on her birthday. The boy seems locked up in his own thoughts and he silently watches from behind the window his little cousin Arthur, who is outside in the garden, playing with, and pretending to be a car. The boy describes his family by their scents: “Cigar smoke came to him and asked him: why don't you play outside in the garden?”. “And perfume came to him, stood behind him, and said: Arthur is outside too”. Then something terrible happens: the boy sees Arthur drown in the pond, but he does not take any action: “He keeps watching, he says nothing”. The story ends quite puzzling: “Later, much later, after many nightmares, in which he drowned, and drowned, and drowned, he could remember what he thought that afternoon: Hullay, hullay, hullay”.

“Hullay” by Cees Nooteboom

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<sup>1</sup> It is unlikely that selection of participants worked in favour of confirming our hypothesis, because statistical power decreased and homogeneity of variance was increased.

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