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WRITING CREATIVE AND ARGUMENTATIVE TEXTS: WHAT'S THE DIFFERENCE?

Exploring how task type affects students' writing behaviour and performance

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Abstract

The aim of this study was to gain insight into writing processes of secondary school students when confronted with fictional and expressive creative writing prompts compared to argumentative writing prompts. Twenty participants (Grade 10-11) each wrote eight texts, four based on creative prompts, the other four based on argumentative prompts, within a set time. A keystroke logging program recorded participants' writing processes. Texts were rated on global quality. Writing motivation and creativity were measured as well. Results showed that creative text production processes had specific features. Students' writing processes were faster, more stable and resulted in longer texts, and fewer revisions. Furthermore, creative as well as argumentative text quality improved if students wrote longer texts in short production cycles. Explorative analyses showed that learner characteristics correlate with writing behaviour as well as with text quality. Students wrote longer texts, had higher writing speed, and wrote better texts when they reported a more positive attitude towards writing and considered themselves more creative. Finally, students who believed in their own creative ability and/or believed that writing requires personal commitment wrote significantly better creative texts. These findings are discussed in the light of the aim to re-introduce creative writing in the Dutch curriculum.

Key Words: creativity, writing behaviour, writing performance, creative writing, secondary education

1

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In the last decades creativity received much attention as one of the '21st century skills': the skills and knowledge considered to be crucial for young people to be successful in work, life, and citizenship in this century (Ananiadou & Claro, 2009). This interest was echoed by a conceptual framework for creativity and critical thinking skills by the OECD Centre for Educational Research and Innovation in the light of their choice for a PISA test on creativity as an innovative domain test for 2021 (Lucas, 2017). Until now, this interest in creativity was not reflected in the current Dutch curriculum for language and literature in upper secondary education. Since 1998 creative writing was eliminated from the national exam program and as a result, virtually disappeared from teaching practice. Instead, both the exam program and the teaching practice focus on expository and argumentative writing, and on communicative, functional texts for everyday use. The writing of poetry, fiction and other creative genres now mainly occurs in primary education and the lower grades of secondary education (Van Burg, 2010, p. 8). Despite the vast amount of research on writing processes there are only a few studies on creative writing processes that we know of (Lubart, 1994, Groenendijk et al. 2008, and Fürst et al. 2017).

In upper secondary education, 10 to 33% of the time in Dutch language classes is spent on writing; students write between one to four longer texts per school year (Meestringa & Ravesloot, 2014), which seems to be insufficient. There are complaints in higher education that students' writing skills do not meet the basic standards and that they experience difficulties with aspects such as spelling, grammar, formal language use, formulating and structuring texts (Bonset, 2010; Kuiken & Van Kalsbeek, 2014; Van Eerden & Van Es, 2014). In addition, both teachers and students in secondary education are dissatisfied with the writing curriculum and all wish to improve the current writing pedagogy (Bonset, 2010).

A way to update the curriculum might be the re-introduction of creative writing. More importantly, by enhancing students' creative writing, their creative thinking could be stimulated, and their academic performance could be improved (Sternberg, 2003). As Sternberg (2009) pointed out: "(...) schools need to place more emphasis on the creative side of writing (and everything else), and that in doing so, they will produce not only more creative writers but also people who are more creative as they go about their lives" (p. 16). Therefore, we want to investigate whether creative writing really requires a different application of students' skills and thus has added value in the curriculum for writing skills, and whether students' motivational aspects are also addressed. To date, no research is available, as far as we know, that provides insight in students' creative writing processes.

Therefore, in this study, we will focus on creative writing, as a domain-specific area of creativity, based on two creative genres: expressive texts about a personal experience and fictional-imaginative texts. For the expressive texts, students can draw on their own memories and feelings, while for the fictional-imaginative texts they have to use their imagination to invent the story themselves.

Obviously, writing on a new topic requires a certain amount of creativity, because meaning construction is a productive, generative and creative process (Flower &

Hayes, 1977; Flower & Hayes, 1984; Galbraith & Baaijen, 2019; Hayes, 1989). However, writing a *creative* text might require more creativity from students than a regular writing task. According to Amabile (1996) a creative task is more heuristic than algorithmic. An algorithmic task has a clear goal, while a heuristic task often does not, and its path is not straightforward (p. 36). This applies to writing as well. First, the constraints of a creative writing task are different: there is no explicit rhetorical goal that the text must achieve. When writing a creative text, be it fictional or expressive, the writer strives to produce a new and original text. For expository writing the rhetorical goal is stated: to inform or persuade readers. Second, the creative writing assignment is often much less constrained and does not provide information about the structure of the text, creating more space and uncertainty in the writer. For expository writing the global text structure is often embedded in the assignment. For example, for argumentative purposes, students may be asked to first provide two arguments for their statement and then disprove a counter argument. Third, writing a fictional or expressive text requires imagination. The author's relation with the object of reference is different because authors do not refer to an external world but create and imagine an external or internal world. This requires inventing a fictional world, creating characters, empathizing with them, and considering their feelings. In the case of expressive tasks, it requires recalling memories and emotions, assigning meaning to those emotions and expressing them.

In this study, we aimed to determine what works to produce relatively good creative and argumentative texts, and to what extent those processes converge and differ.

1. THEORETICAL BACKGROUND

In the present study, we examined the relations between students' writing behaviour and the quality of their final texts. Such relationships have been studied in creativity research as well as writing research. Therefore, we will discuss process theories in both domains.

1.1 *The creative process*

Sawyer (2012) distinguished two approaches in creativity research: the individualist and the sociocultural approach. The sociocultural approach defines creativity as "the generation of a product that is judged to be novel and also to be appropriate, useful, or valuable by a suitably knowledgeable social group" (Sawyer, 2012, p.8.). This is known as Big-C creativity, eminent creativity, shown for instance by recognized artists. Hayes (1989) used similar terms to define creativity in writing. In his definition, 'novel' varied from 'unusual' to 'unique', while 'appropriate' meant that the creative product had to be suitable for the task, intended audience, and context. For instance, if the task was to write a short story, a rap song might be original, but inappropriate

and therefore not considered 'creative'. Furthermore, recipients also had to value the creative act as a text (Hayes, 1989).

The individualist approach focuses on the individual creative process and was defined as "a new mental combination that is expressed in the world" (Sawyer, 2012, p. 7). Such a combination was considered creative if it was new to the individual who generated it (Sawyer, 2012, p. 8). This was also known as little-c creativity, which everyone could experience in everyday life. In the present study, we adhered to this definition of creativity as novel and appropriate and we did not focus on eminent creativity, but on the little-c processes in secondary school students' creative writing.

Over the last years, various creative process models have emerged. Traditionally it was described as consisting of four stages: preparation, incubation, illumination, and verification (Wallas, 1926). During preparation, the focus is on absorbing information and engaging in problem finding and definition. Then, during incubation, the artist takes a step away from the creative process, until illumination, when a solution or great idea suddenly comes to mind. Finally, in the verification phase the final product is created and edited.

Since then, model development has focused on the distinction of subprocesses such as problem finding, incubation, definition, divergent thinking, synthesis, and analogy as well as their organization (Lubart, 2009). Mumford et al. (1991) and Finke et al. (1992) proposed more flexible, interactive models for the organization of these subprocesses instead of the stage model. Finke et al. (1992), for example, proposed the cyclical Geneplore model in which two sets of processes continuously interact: generative processes, that create ideas on the one hand and exploratory processes, that examine, elaborate, and test these ideas on the other hand. Together these processes lead in cyclical sequences to creative products.

1.2 The creative writing process

In their well-known model of the writing process, Flower and Hayes (1980) distinguished three main processes: retrieving and structuring ideas through planning, translating ideas into text, and reviewing text produced so far. They proposed a monitor that overviews the writing process to determine when to alternate between subprocesses. Like the Geneplore model, Flower and Hayes's model is interactive as switching between subprocesses can occur: generating ideas in the planning component of the model might lead to exploring and selection (the organizing process of the planning component), but also to formulation of new text, which in turn can lead to the generation of new ideas. Although Hayes (Hayes & Nash, 1996 & Hayes, 2012) extended and elaborated this model since then, for instance by adding motivational variables (Hayes & Nash, 1996), the basic cognitive subprocesses remained the same. It is a general and flexible model, which can be adapted to specific task conditions, such as for creative and argumentative texts. Both tasks require three cognitive processes—forward idea generation, evaluation and reflection, and linguistic production processes.

Galbraith and Baaijen (2018) proposed the dual-process model of writing, that resembled the Geneplore model (Finke et al. 1992), which focused on writing instead of creative thinking in general. In this model the generation and linguistic production processes are more intertwined: writers alternate between knowledge-constituting and knowledge transforming processes. During the knowledge-constituting process writers synthesize content out of sub-conceptual units (p. 201), and as a result their thoughts take shape *while* writing. We see similarities between both models, but their production modalities differ. In the dual-task model verbal production drives generation. During the knowledge-transforming process, external rhetorical goals direct the content retrieved from episodic memory, which is similar to the exploratory process of the Geneplore model, although while writing, the writer's rhetorical goals guide the elaboration, examination, and exploration of ideas.

Lubart (2009), discussed the Flower and Hayes model when searching for a specific creative writing process model, but did not connect it to the creative task domain. He reported that there is some creativity in all writing, but oversimplified the Hayes and Flower model by labelling it as a kind of linguistic problem-solving process (Lubart, 2009, p. 161). In Hayes and Flower's view the writer must not just solve a linguistic problem, but a rhetorical problem, of which the linguistic component is one element (Flower & Hayes 1980).

Lubart (2009) focused on interview studies with professional novelists and poets, conducted by Csikszentmihalyi (1996) and Doyle (1998). According to Csikszentmihalyi (1996), the creative writing process requires openness for ideas and thoughts from the unconscious on the one hand and constant critical judgement by its creator on the other. These processes should be balanced to enable writers to experience the writing flow (1996, p. 264).

Based on her interview data, Doyle (1998) concluded that authors 'live in two spheres of experience' during writing: a 'writing realm' and a 'fiction world'. The fiction world is characterized by *non-reflective* narrative improvisation: authors enter this world to develop their stories. Doyle reports for example on an author who entered the fictional world of a poodle and thereby explored and elaborated the story. In the writing realm, on the other hand, writers withdraw from everyday life to write, plan, and reflect on their work, thereby activating cognitive processes such as recognizing, comparing, analogizing, and evaluating, in this realm thinking is intentioned, purposeful, and reflective.

Doyle also stressed the importance of revising, which all the authors she interviewed mentioned. While revising, writers constantly shift between the writing realm and the fiction world. Finally, since the fiction writing process is not linear, Doyle argued for a cyclical model instead of the traditional four-stage model (Wallas, 1926).

Lubart (1994; in Lubart, 2001 and Fürst et al., 2017) followed general research on writing processes by suggesting that the sequencing of creative writing subprocesses might be as important for text quality as their presence or absence, which is a well-known finding from research on expository and argumentative texts (Rijlaarsdam &

Van den Bergh, 1996, 2006). He found in an experimental study that students' stories were more creative if they evaluated quite early in the creative writing process, than if they evaluated late or evenly spaced, or if they did not evaluate at all (Lubart, 1994). In an experimental study, Fürst et al. (2017) aimed to confirm this theory. The researchers manipulated the influence of different patterns of two basic cognitive processes—generation and selection—on creativity observed in texts. Students ($N = 174$) wrote a relatively short text in a genre of their own choice—poetry, fiction, or nonfiction—, and received varying instructions on when to use generation and selection processes during four phases of the writing process—preparation, draft writing, clarification/development, and correction, while a control group received no instructions. No effects of the experimental groups compared to the control group were observed on 'originality' and 'quality' of the written texts, due to design issues like lack of experimental fidelity.

One creative writing process study supported the theory that managing subprocesses over time influenced text quality. Groenendijk et al. (2008) investigated secondary school students' poetry writing (11th grade) and found that a high rate of initial text production (fluency) was positively associated with text quality, whereas greater pausing had a detrimental effect on quality, in almost all writing phases. The number of high text level revisions at the end of the writing process was positively associated with final text quality.

Although these studies by Fürst et al., Lubart, and Groenendijk et al. differed with respect to their design, participants' age, and writing tasks, they all found that students' sequencing of creative writing subprocesses influenced the final texts' quality and creativity. This is in line with non-creative writing process studies in which different cognitive activities contributed to text quality at different moments in the writing process (Van den Bergh et al., 2015; Breetvelt et al., 1994).

Interestingly, the creative writing subprocesses proposed in the scarce literature did not seem to differ from those in general writing research. Flower and Hayes' general writing process model presented in the 1980's contained the basic cognitive activities found in all kinds of writing and all kinds of writing tasks. Therefore, all cognitive activities seem to be activated in most types of writing processes, but with different weights and configurations (Van den Bergh et al., 2015).

In sum, the creative writing process consists of generative processes in the fictional world as well as exploratory processes in the writing realm, that lead in cyclical sequences to creative texts, driven by verbal production. Furthermore, the sequencing of the subprocesses of the creative writing process might be crucial for the quality and creativity of creative texts.

1.3 Writing motivation, creative ability and self-efficacy

In her componential theory of creativity Amabile (1983, 2012) distinguished three intra-individual components that influence someone's level of creativity: (1) domain-relevant skills, one's technical skills and innate talent in a specific domain (i.e.

writing), (2) creativity-relevant processes, which include flexibility, and creative thinking skills, and (3) task motivation, the motivation to undertake a task (e.g. to write a creative text) because it is interesting, enjoyable, or personally challenging, for intrinsic reasons. The extent to which these three components are present determines, together with the social environment, someone's level of creativity. Note that here again, we see a relation with the current writing process models which include domain-specific components (the linguistic component in writing), cognitive components (generating ideas, ordering, classifying, evaluating) and task motivation (Hayes, 1996, 2012).

Intrinsic motivation is the central tenet of Amabile's componential theory of creativity. In an experimental study Amabile (1985) found that writers who were instructed to concentrate on extrinsic reasons for creative writing wrote less creative poems than those asked to focus on intrinsic reasons for writing or those who received no reasons for writing. This suggests that intrinsic motivation and attitude towards writing are important learner variables related to creativity. In his search for cognitive processes in creativity, Hayes (1989), stated that the major difference between creative and non-creative people is motivation: devotion to work, independence, drive for originality, and flexibility. In the domain of writing, motivation might be indicated by writing affect, a positive affective relation to the act of writing.

To assess students' attitude towards writing, we will include different scales from existing instruments that will assess writing beliefs that focus on the affective aspects of writing. With respect to Amabile's second model component, we will focus on creative thinking skills and will include a scale to measure students' self-reported creative ability.

Finally, because research has shown that students' self-efficacy beliefs about writing affect their performance as well as motivation (Pajares, 2003), we will also include a scale to assess students' self-efficacy in writing.

In conclusion, empirical findings that certain activities in creative writing are associated with higher creativity of the final product, and that differences in managing these activities is decisive, are rare. For hypothesis building we therefore refer to what we know from writing in response to non-creative tasks. Furthermore, the crucial feature of creative writing might be the switch from the writing realm to the fiction world (Doyle, 1998). When writing fiction, writers participate in their self-created or, in the case of expressive texts, internal world. This might affect content generation, which can be fast and fluent, without frequent disruptions from reflection or switches to the writing realm, although we admit that this is somewhat speculative.

Furthermore, it is likely that individual learner variables (in particular domain-specific motivation and attitudes, task specific creative ability and self-efficacy) may influence the writing process and the quality of the final product, in particular in creative writing tasks.

2. RESEARCH QUESTIONS

In the present study we investigated whether students' writing processes differed due to differences between creative and argumentative tasks. Furthermore, we investigated which writing behaviours affected the quality of the resulting text, and to which extent those effects differed as a result of task type. Finally, we explored the relations between learner characteristics and students' writing behaviour and performance. Thus, we related task type (creative-argumentative), writing process, writing performance (in terms of text quality) and learner characteristics to each other (see Figure 1). From now on, we will use the term Writing Behaviour as an operationalization of writing processes, because of the specific method we implemented to observe them. Text production processes were namely captured with keystroke logging, which produces scores on observable behaviours. What keylogging does, in its simplest form, is register that something is happening (a character typed, a space bar touched) or not (a 'pause'), and where it happens: something can be typed in forward direction, adjacent, or in backward direction, inserted or deleted in a fragment that was typed in an earlier instance.

Our research questions were:

- 1) To what extent does adolescents' Writing Behaviour differ during creative or argumentative writing?

We investigated the relations between task variables (explicit creative versus argumentative) and Writing Behaviour (Figure 1: components Task Type and Writing Behaviour). We chose to study five main variables, based on writers' actions (or pauses) and time units: (1) production quantity, (2) production speed, (3) revision ratio, (4) pause behaviour and (5) variation in flow. Tentatively, since we expected that in the writing realm content generation would be fast and fluent (Doyle, 1998) and based more on associative generation processes than in argumentative writing, we expected that the production quantity in creative writing would be higher than in argumentative writing. We also expected a higher level of flow (Csikszentmihalyi, 1996) in creative text writing, indicated by a higher production speed. For revision, we expected more online revision in creative writing (Doyle, 1998), because of the faster and more productive process, which calls for more small impromptu edits. Finally, since the writing realm is not limited by rhetorical goals, we expected less variation in flow in creative writing than in argumentative writing, and we expected the creative process to be more continuous, with shorter but more productive cycles between pauses.

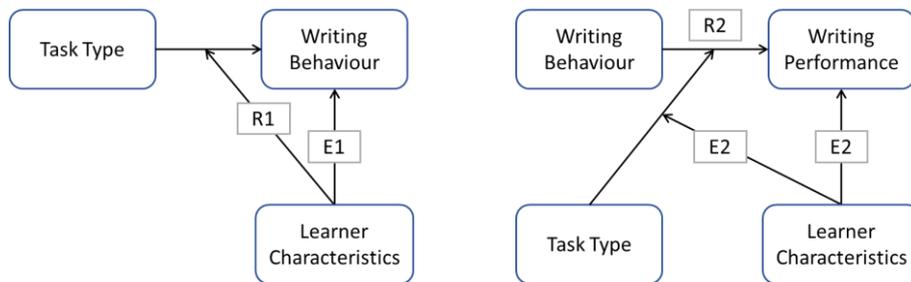
- 2) To what extent does the effect of Writing Behaviour on Writing Performance vary due to task type (Figure 1: components Task Type, Behaviour and Writing Performance)?

Second, we tested which Writing Behaviours contributed to the prediction of the quality of the resulting text in creative and argumentative tasks, and to which extent those predictions differed as a result of task type. If production

quantity, production speed and pause behaviour and flow variation are key for creative writing, we expect that they would predict the quality of creative texts. Revisions could interrupt this flow and might therefore be negatively related to the creativity score. We expected that these variables would also contribute to the quality of argumentative texts, but to a lesser extent.

3) For both questions we also explored the contribution of learner variables. First, we extended Research Question 1 by exploring to which extent learner variables affect Writing Behaviour in creative and argumentative tasks differently as moderator variables (see Figure 1, left-handed panel, E1). Second, we extended Research Question 2 by exploring to which extent learner variables affect Writing Performance directly and moderated the effect of Task Type on the relation between Writing Behaviour and Writing Performance (see figure 1, right-handed panel).

Figure 1. Structure of variables for Research Questions (R) and Explorations (E). Left-handed panel Research Question 1 on the effect of task type on writing behaviour; Right-handed panel: Research Question 2 on the effect of task type on the relation between writing behaviour and writing performance.



3. METHOD

3.1 Research design

We set up a study with a within subject design. To maximize generalizability across domains (creative-argumentative), we chose to implement four tasks for each domain per participant. Earlier writing research has shown that the intra-variability because of the interactions between participant and topic/task is considerable, both for writing performance (Schoonen, 2012; Van den Bergh et al., 2012), and writing processes (Tillema, 2012; Van Weijen et al., 2008; Rijlaarsdam et al., 2012). As we aimed to generalize about the constructs of creative and argumentative writing, instead of participants, we chose to collect multiple texts per participant instead of single texts from multiple participants.

Participants wrote two texts per session, during four after school sessions, with minimal guidance. Text production processes were recorded via a keylogging tool, Writing Performance was indicated by holistic text quality scores, while Writing

Domain-Specific Motivational Aspects and Creative Ability were measured using questionnaires.

3.2 Participants

Participants were 20 students (15-18 years old, $M = 16.38$, $SD = 0.93$), selected from a larger group of volunteers ($N = 37$) from seven different classes in a large secondary school in the Netherlands. All were enrolled in the two highest tracks of secondary education: upper higher general secondary education or upper pre-university education (10th-11th Grade). From this sample we selected students known to be strong writers ($n = 12$), and average writers ($n = 15$), using their teachers' assessment of their writing skills, based on the texts students wrote during their lessons and earlier assessments. Since we were interested in possible differences between processes and weak writers are known to show hardly any variation in their writing processes (Braaksma et al., 2004), they were not selected for this study ($N = 10$).

Shortly before the data collection started, five participants withdrew for several reasons. One participant missed most of the writing sessions, while all the data for one student and some of the texts were lost during data collection, due to technical problems. All in all, the final data set consisted of 147 texts written by 20 students: 8 strong writers (6 Female) and 12 average writers (9 Female). Students received a small financial reward. Both students and parents gave active consent for students' participation in the study.

3.3 Writing tasks

All tasks involved writing a short text, of approximately 250-300 words, each requiring about 20 minutes of writing. Appendix A provides examples of a creative and an argumentative task.

3.3.1 Creative tasks

To increase generalizability, the four creative tasks covered two genres: expressive and fictional-imaginative texts. Three tasks were designed for this study, a fourth was borrowed with permission from previous research (Janssen & Braaksma, 2016). The expressive tasks prompted participants to write about a personal experience: a personal story about an impressive moment in their life and a story based on a picture from their youth. For one fictional task the students chose one picture from three pictures of people in a strange situation, such as a man lying on the ground covered in tomato sauce and invented a story. The other fictional task provided participants with the story beginning and prompted them to continue and finish the story themselves.

3.3.2 *Argumentative tasks*

The argumentative tasks were designed and pretested by the first author. We based them on textbook tasks for Dutch language classes and chose tasks commonly used in the upper grades of secondary education. Two tasks asked for a response to a newspaper article. For the other two tasks we provided no sources. For the response tasks students were asked to write a letter to the editor of a newspaper, about smart children or game addiction and a response to a newspaper article that we provided, either about lessons in healthy eating in primary education or about educational testing. For the task without textual input, students were asked to write a review about an app, a movie, book or video game of their own choice and a promotional text about their own school for the school website.

3.4 *Measures*

We collected data for three types of variables: (1) Writing processes or students' actual Writing Behaviour, (2) Writing Performance, indicated by Text Quality and (3) Domain-specific learner variables (students' Affective Writing Attitude, Writing Beliefs, Self-Efficacy in writing, and Creative Ability) (see Figure 1).

3.4.1 *Writing behaviour*

All the texts were written on the computer using MS Word while Writing Behaviour was recorded with a keystroke logging program: Inputlog (version 7.0.0.11; Leijten & Van Waes, 2013). Inputlog registered all behavioural activities on the keyboard and the mouse movements and enabled us to reconstruct the writing process. Inputlog version 7.1.0.47 was used for data screening and cleaning.

We focused on variables from three Inputlog analyses: summary, pause and fluency analysis. The summary analysis contained a statistical summary of the aggregated logging data such as total pausing time, total process time and total characters, words, and paragraphs in the main document. The pause analysis contained logging data related to pausing behaviour, such as the mean pause length and pause locations (Van Waes & Leijten, 2015). There is no objective definition of pauses in writing research. However, we chose to include only pauses of two seconds or longer in our analyses, as these are generally seen as indications of higher-level cognitive processes (Chenoweth & Hayes, 2003; Wengelin, 2006). The fluency analysis provided statistical information about the number of keystrokes, e.g. strokes per minute.

We selected ten Inputlog variables for further analyses, based on Van Waes and Leijten (2015) and Vandermeulen et al. (2020). For three variables scores per episode were provided by Inputlog (see Table 1, table note 2) which enabled us to study whether those variables differed in specific phases in the writing process instead of the process as a whole.

Table 1. Explanation of the variables generated by Inputlog

Variables	Explanation	Inputlog label ²
Production Quantity		
Production in the final text	Total number of characters <i>in the final text</i> including spaces. Indication of final text length.	PI CIFTOTS Total incl spaces
Production during the process ¹	Total strokes produced <i>during the writing process</i> , without inserted and replaced characters. Indication of all production during the process, whether deleted during the process or not.	SS Total strokes
Production Speed		
Speed in the final text	Total number of <i>characters in the final text</i> including spaces per minute. Indication of the speed with which the finished text was typed.	PI CIFTOTS Per Minute incl spaces
Speed during the process ¹	Average number of strokes <i>produced during the writing process</i> per minute, without inserted and replaced characters. Indication of processing speed for all strokes whether they were deleted or not.	S Average Strokes per Minute
Revision ratio		
Revision ratio	This ratio takes into account that writers often produce more characters during the writing process than the characters that remain in the final text. If equal to 1, no deletions have taken place. A lower ratio indicates more deletions. Calculated as the total number of characters in the final text plus the total number of non-character keys divided by the total number of characters typed during the writing process.	Calculated manually
Pause Behaviour		
Number of P-Bursts	Number of Pause-bursts (P-bursts). A Pause-burst is defined as ‘the string of actions delimited by an initial and end pause exceeding the defined pause threshold.’ (Leijten & Van Waes, 2015, p. 86). The less P-bursts the longer the text production cycle is during the writing process. When two processes have a similar amount of production, the process with less P-bursts had longer text production bursts during the writing process and is therefore less fragmented.	PT G Number of P Bursts
P-bursts per minute	Number of Pause-bursts produced per minute. The higher the number, the shorter the writing bursts during the writing process.	PT G Number of P Bursts per min
Length of P-Burst	Mean number of characters typed during the writing process in P-bursts. Indication of pause productivity: a higher mean indicates a higher amount of post-pause production.	PT G Mean Typed In P Bursts chars
Proportion of pause time ¹	Proportion of the total pausing time—above the set pause threshold—measured over the total writing process time versus the total active writing time (i.e. text production).	PT TPT Proportion of pause time
Variation in Flow		
Flow Variation	Variation of number of keystrokes across the whole process. Calculated as the standard deviation of the average amount of keystrokes per minute.	S S Standard Deviation Overall

¹ For Production during the process, Speed during the process and Proportion of pause time scores are also available for five process intervals, labeled by Inputlog as: AM TS Interval 1/2/3/4/5, AM SPM Interval 1/2/3/4/5 and PP Interval 1/2/3/4/5.

² Inputlog variable: the label as it appears in Inputlog 7.1.0.47, according to the manual (http://www.inputlog.net/wp-content/uploads/Inputlog_manual.pdf).

All variables were generated automatically by Inputlog, except the Revision score which was calculated manually by adding the total characters in the final text to the total non-character keys used during the writing session divided by the total number of characters typed during the writing process.

3.4.2 *Writing performance*

All texts were rated using the Consensual Assessment Technique (Amabile, 1996) in which texts are judged holistically by expert raters. Amabile stressed that “judges should be instructed to rate the products relative to one another on the dimensions in question, rather than rating them against some absolute standard” (1996, p. 42). Therefore, we implemented comparative judgement and instructed raters to compare two paired texts holistically and decide which of the two was best. For the creative texts, the ratings focused on the texts' creativity, for the argumentative texts the aim was to judge global text quality, in the light of the task's communicative purpose (See Appendix B for the assessment instruction for the creative and argumentative tasks.) Ratings were carried out in D-PAC, an online tool for assessing competences, based on comparative judgement (Van Daal et al., 2017). The D-PAC analysis produces a rank-order from the weakest to the best text, which can be interpreted as z-scores, and estimates for rater reliabilities.

Twenty-four Dutch language and literature teachers and three researchers were involved, with 1 to 36 years of teaching experience in upper secondary education. We set up separate assessments for each of the eight tasks. For each task, a D-PAC algorithm created random pairs of texts, and then randomly assigned these pairs to raters. Each text was part of at least 16 and at most 19 pairs. Each text was evaluated by 10 to 13 raters.

The reliability of the assessments per task was sufficient, except for argumentative task 3 ($< .60$) (see Table 2). Since students could write reviews about a topic of their own choice, this topic variation might have caused more difficulties for the judges comparing those texts, which might have affected the judgement's reliability (Van Daal, 2020).

As the ratings were organized per task, this resulted in eight independent sets of ratings.

3.4.3 *Learner variables*

We selected two sets of variables for our analyses: domain-specific variables ('writing variables') and a general variable, Creative Ability. From existing validated instruments measuring characteristics of learners related to writing, we selected 'writing scales' that focused on attitudinal or affective aspects of writing, administered in one composite questionnaire. The other scale we included in the study measured Creative Ability (Questionnaire B).

Writing variables. For measuring writing variables related to affect and motivation we combined four existing instruments in a questionnaire, containing 69 items in total (see Table 3). Items indicated five scales, measuring students' Affective Writing Attitude, two Writing Beliefs (Writing requires Thinking and Writing is Emotionally Intense) and Self-Efficacy. All items were formulated as statements, accompanied by a 5-point Likert response scale (e.g., 1 = strongly agree, 5 = strongly disagree). The reliability of all scales was sufficient to good (Cronbach's alpha: .76 - .94).

Creative ability. To measure students' self-reported Creative Ability, we used a questionnaire developed and tested by Stubbé et al. (2015), which consists of 44 items that represent seven constructs: inquisitiveness, imaginativeness, focus on output, proud of work, dare to be different, perseverance and ability to collaborate. A 7-point Likert scale was used (1 = does not apply to me, 7 = completely applies to me) to indicate students' perception of their creative competences (Cronbach's alpha: .96).

Table 2. Reliability of the assessments

Task type	Topic	SSR*
Creative		
1	Fictional: Finish this story of which the beginning is given	.74
2	Expressive: Write a story about an impressive moment in your life	.81
3	Expressive: Write a story about a picture from your childhood	.79
4	Fictional: Write a story based on one of these three pictures	.62
Argumentative		
1	Response: Write a response letter to a newspaper about smart children or game addiction	.67
2	Write a promotional text about your own school for the school website	.81
3	Write a review for the school newspaper about an app, book, movie or computer game	.57
4	Response: Write a response on an internet forum about healthy eating in primary education or about testing in education	.67

*SSR = Scale Separation Reliability (Verhavert et al., 2018)

Table 3. Overview of measures for learner variables instruments and source

Variables*	Scales	Num-ber of items	Cronbach's alpha		Descriptives		Item examples	Source		
			Sample (n=20)	Reference group (National sample n=7600)**	Sample (n=20)	**Reference group				
			M	SD	M	SD				
Affective Writing Attitude	Affective attitude	9	.87	.92	3.5	.68	3.3	.86	I enjoy writing.	Rijlaarsdam (1986)
Writing Beliefs	Writing requires thinking	4	.76	.80	3.0	.76	3.3	.59	Writing helps me to understand the complexity of ideas.	Baaijen et al. (2014), based on White & Bruning (2005)
Self-efficacy	Writing is emotionally intense	5	.86	.76	3.0	.60	3.3	.69	Writing is often an emotional event.	
Creative ability		18	.94	n.a.***	3.7	.52	n.a.		I can mention reliable arguments in my text.	Braaksma et al. (2018)
		44	.96	n.a.	5.2	.72	n.a.		I like to discover new things.	Stubbé et al. (2015)

3.5 Procedures

The data collection took place over four sessions, one hourly session per week, in the school computer room after school hours. There was a risk that students would not complete the second questionnaire seriously if we administered both online questionnaires simultaneously, because their completion would take a lot of time. Therefore, we administered the writing questionnaire before session 1 and the creative ability questionnaire halfway, between sessions 2 and 3. It should be noted that we did not mention that this questionnaire was about creativity. It was called the Complex assignments questionnaire and it was not immediately possible to deduce from the items that it focused on creativity. We decided not to administer the questionnaire after session 4 to avoid the risk of low motivation and data loss.

Students received the writing assignments on paper and on the computer. To avoid crossover effects between task types within a session, they wrote either two creative or two argumentative texts per session. Furthermore, to prevent an order effect, we randomly created two groups of participants (Amabile, 1996, p. 223), which each received the tasks in a different sequence (task 1-8 versus task 8-1).

Since students were not used to writing creatively at school, we provided them with a 2-minute warm-up task preceding the creative writing tasks. We created two warm-up activities, distributed over the two creative writing sessions. We used one of Guilford's Alternative Uses Tasks (1967): students received a picture of a paper clip and had to write down as many different uses for the paper clip as possible. For the other warm-up task, they received a picture of a dog in a garden, looking for something and wrote down as many things as possible the dog might look at. We distributed the writing tasks after the warm-up task. No warm-up tasks were used for the argumentative tasks as students were used to performing those.

In addition, we focused on expression in the creative assignment by giving students the following instruction: 'Do not worry about spelling, grammar, font and the like while writing. It is mainly about the content of your story.' We chose this formulation to encourage students to quickly write a first draft of their story, as is also customary in school practice. We did not give this instruction before the argumentative texts since this is not common in argumentative writing.

Finally, since participants tend to score higher on creativity tests, when they are aware that their creativity is being tested (Amabile 1996; Manske & Davis, 1968), we avoided the term 'creative' and asked them instead to write an original text. So students were not informed that their texts' creativity would be assessed.

The sessions were led by the first author. For each task students were allowed 20 minutes of writing time, after which there was a 5-minute break before all participants started the second task simultaneously. During the break students were allowed to finish their text if necessary, but most students finished their texts within the set time.

3.6 Data analysis

We first checked for outliers via a boxplot analysis and removed observations that were outside reasonable ranges ($n_{\text{processes}} = 12$; 8%). Manual inspection of the keylogging scripts revealed that these scores were mostly due to typical keyboard and mouse behaviours. We also checked for correlations between the process variables, as indicators of productivity, speed and pauses are likely to correlate although they represent slightly different constructs. Appendix D, Table 10, contains the correlations between the process scores. The pairwise correlations for the two Production scores and the two Speed scores were quite high: production .84 (Argumentative tasks) and .95 (Creative tasks), speed .88 (Argumentative tasks) and .79 (Creative tasks), but still left a substantial percentage of the variance unexplained. As this is an exploratory study, we still included all scores in the subsequent analysis.

The nested data structure—for each student we had scores for four tasks per task type—required the use of multilevel analyses using mixed models in SPSS 25.

We evaluated the fit of subsequent models by means of a likelihood-ratio test, in which the difference in $-2 \log$ likelihood of nested models is compared (with the difference in estimated parameters as degrees of freedom). In the basic model, Model 0, an intercept and three random components were estimated: variance between subjects, variance between tasks, and their interaction (plus error variance). In Model 1 we added Task Type (creative versus argumentative) as fixed factor. To explore whether effects of Task Type on Writing Behaviour were moderated by learner variables, we added two more models to the models for research question 1: Model 2 with the specific learner variable as fixed factor, and Model 3 allowing interaction between Task Type and a learner variable.

For research question 2 we tested whether the relationship between Writing Behaviour and Writing Performance varied due to Task Type. Therefore, we compared three subsequent models, with Writing Performance as dependent variable. Model 1 included the fixed effect of Task Type and the three random components and we compared this model¹ to the others. In Model 2 we added the factor Writing Behaviour to explain Writing Performance, and in Model 3 the interaction between Task Type and Writing Behaviour. If Model 2 fit the data better than Model 1, that would indicate a relation between Writing Behaviour and Writing Performance. If Model 3 showed a better fit than Model 2, that would suggest that Writing Behaviour contributes differently to Writing Performance depending on the Task Type. To explore whether the relation between writing processes and writing performance was moderated by learner variables, we extended these series of models. In Model 4 we added a learner variable to the equation to check whether it explained Writing

¹ Note that the observed effect of Task Type on Writing Performance is not relevant: we do not study whether students write better creative texts than argumentative texts. However, we needed this model as steppingstone for the next models. Remember that we measured Writing Performance in both task types independently from each other.

Performance, and then added the interaction between Task Type and learner variable that indicates a moderator effect of Task Type on the relation between the learner variable and Writing Performance. From Model 4 onwards, we repeated this procedure for all learner variables presented in Table 3.

4. RESULTS

4.1 RQ 1: To what extent does adolescents' writing behaviour differ during creative or argumentative writing?

Outcomes for the question whether and to which extent Writing Behaviour differs between tasks are shown in Table 4. For descriptive information about scores for both task types see Appendix C.

Table 4. Effects of task type (creative vs. argumentative task) on writing behaviour

Writing behaviour	-2 loglikelihood	Comparison			
		models	$\Delta\chi^2$	Δdf	<i>p</i>
Production in the final text	1,982.17				
	1,976.90	0 vs 1	5.27	1	.020*
Production during the process	1,990.95				
	1,987.46	0 vs 1	3.5	1	.062
Speed in the final text	1,524.80				
	1,518.44	0 vs 1	6.36	1	.012*
Speed during the process	1,215.31				
	1,212.71	0 vs 1	2.6	1	.107
Revision Ratio	265.00				
	257.41	0 vs 1	7.59	1	.006*
Number of P-Bursts	1,070.55				
	1,070.34	0 vs 1	.2	1	.652
P-Bursts per minute	316.84				
	316.80	0 vs 1	.04	1	.852
Length of P-burst	1,228.28				
	1,227.22	0 vs 1	1.07	1	.312
Proportion of Pause time	968.02				
	967.58	0 vs 1	.257	1	.612
Flow Variation	532.61				
	525.35	0 vs 1	7.26	1	.007*

Note:

Model 0. Intercept + [S2student + S2task + S2residual]

Model 1: 0. + Task Type

Task Type affected four Writing Behaviour variables: Production in the final text, Speed in the final text, Revision Ratio and Flow Variation, but not pause behaviour variables. Compared to argumentative tasks, we observed more and speedier production during task execution in creative tasks, with fewer revisions and a more constant flow (see Table 5).

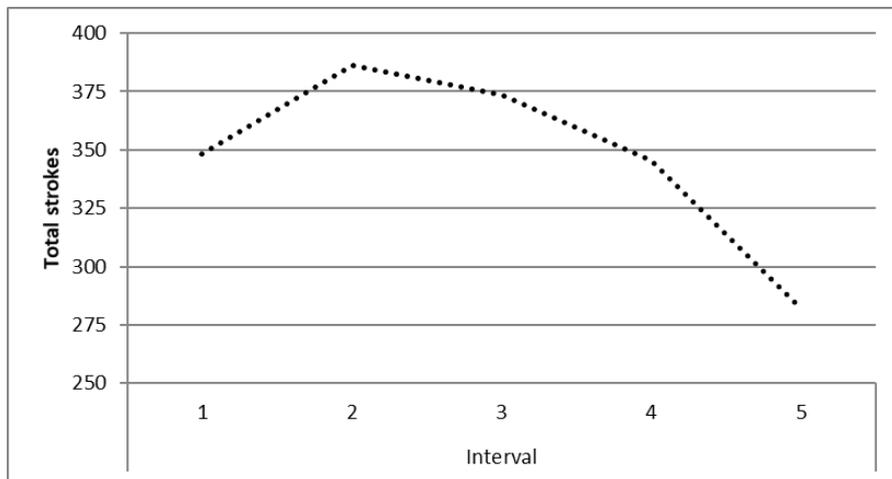
Table 5. Effect of creative tasks on writing behaviour for four variables (M, se) with three variance components

Variables	Intercept	Se	Crea- task- effect	se	$S^2_{subject}$	se	S^2_{task}	se	Residuals	se
Production in the final text	1.617.81	122.72	344.16	124.23	149,222.40	54,799.37	23,144.59	16,061.73	124,973.40	17,303.47
Speed in the final text	229.65	19.63	59.42	18.78	4,212.84	1,495.19	527.63	369.07	2,951.28	403.23
Revision ratio	1.05	0.04	0.11	0.03	.018	.006	.002	.001	.008	.001
Flow variation	12.87	0.60	-.084	0.24	6.69	2.212	.005	.061	1.77	.24

Note. Remember: $|estimate| / se > 1.965; p < .05$

We also ran the same analyses for scores per interval for three writing behaviours (see Table 1 note 1). Interval effects were found for the production and speed variables, but the interval effect did not interact with Task Type. See Figure 2 for an example of the pattern of the effect. Furthermore, no interval effect was observed for Pause time. This implies that the task effects reported in Table 5 are effects of the creative writing tasks on the process as a whole, which do not seem to vary during writing. Therefore, we refrained from interval analyses for the other research questions.

Figure 2. Interval effect on productivity (total strokes per interval). Interval effects: 1<2, 3<2, 4<3, 5<4, 5<1



4.2 Exploration RQ1. Do learner variables moderate the effect of task type on writing behaviour?

We tested all Writing Behaviour variables (Table 2) with all indicators for moderator effects. As potential moderator variables we included Affective Writing Attitude, two Writing Belief constructs (Writing is Emotionally Intense, Writing requires Thinking), Self-Efficacy, and Creative Ability. The model testing revealed that Production in the final text and during the process and Speed in the final text were sensitive to levels of some of the learner variables. Outcome estimates for the best fitting models, shown in Table 6, indicate which learner variables contribute positively to Writing Behaviour scores, as main factor, or as interaction term with Task Type.

Table 6. Effects of task type, learner variables (centred) and their interaction on writing behaviour.

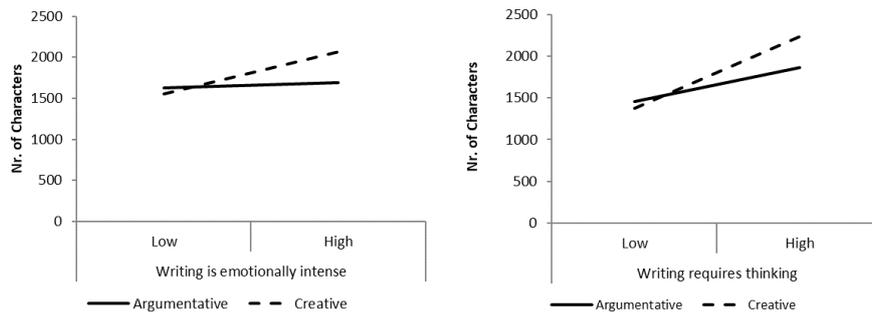
Learner variable		Moderator effects			
		Production in the final text		Production during the process	
		Effect	se	Effect	se
Writing is emotionally intense	Task Type	345.17*	125.08	149.32*	68.07
	Learner variable	159.54	142.36	35.72	132.40
	Interaction	239.04*	107.48	233.54*	96.53
	$S^2_{subject}$	120,109.55*	45,226.33	106,440.41*	39,323.17
	S^2_{task}	23,924.08	16,204.14	3,334.19	4,931.95
	<i>Residual</i>	119,200.86*	16,484.09	98,457.98*	13,402.34
Writing requires thinking	Task Type	340.75*	119.26	143.90*	68.60
	Learner variable	213.38*	103.68	160.71	96.55
	Interaction	220.94*	80.39	179.69*	72.71
	$S^2_{subject}$	93,655.35*	36,472.41	82,474.59*	31,511.75
	S^2_{task}	21,240.08	14,686.98	3,526.59	4,947.72
		Main effects only			
		Production in the final text		Production during the process	
		Effect	se	Effect	Se
Affective Writing Attitude	Task Type	338.72*	121.65	148.26	69.99
	Learner variable	391.14*	101.31	303.78*	95.68
	$S^2_{subject}$	76,870.98*	31,085.10	70,504.63*	27,493.74
	S^2_{task}	21,884.71	15,214.88	3,576.93	5,129.22
	<i>Residual</i>	124,903.47*	17,282.36	103,283.59*	14,043.53
		Speed in the final text			
		Task Type	59.06*	18.75	
		Learner variable	45.26*	19.79	
		$S^2_{subject}$	3,266.41*	1,182.56	
		S^2_{task}	525.43	365.69	
		<i>Residual</i>	2,946.06*	401.80	

Reference category Task Type: Non-Creative *: $p < .05$

Results indicated that two Writing Beliefs, Writing is Emotionally Intense and Writing requires Thinking affected Production in the final text and during the process more in creative tasks than in argumentative tasks (see Table 6). For both variables, this moderator effect reflects the notion of personal task investment: writing involves emotions and thinking (see Figure 3 for interaction patterns). Affective Writing

Attitude related positively to both production measures and production speed in the final text per minute regardless of task type (main effect; see Table 6).

Figure 3. Interaction effects of writing beliefs and task type on production during the process. beliefs scores (x-axis) are on an interval scale; 'Low' represents minus 1 sd, 'High' plus 1 sd from the mean belief score



4.3 To what extent does the effect of Writing Behaviour on Writing Performance vary due to task type?

We first explored whether the variation in Writing Behaviour explained Writing Performance (Model 1), and then whether this relation differed for the two types of writing tasks (Model 2). We ran these analyses for all ten writing behaviour scores (see Table 7).

Table 7. Effects of writing behaviour and task type on writing performance

Model	-2 loglik	Models	Comparison		
			$\Delta\chi^2$	Δdf	<i>p</i>
0. Cons	467.20				
1. + Production in the final text	454.18	0 vs 1	13.02	1	<.001
2. + Production in the final text*Task Type	451.93	1 vs 2	2.24	1	.134
1. + Production during the process	454.34	0 vs 1	12.86	1	<.001
2. + Production during the process*Task Type	446.55	1 vs 2	7.79	1	.005
1. + Number of P-Bursts	463.16	0 vs 1	4.03	1	.045
2. + Number of P-Bursts *Task Type	462.13	1 vs 2	1.04	1	.309

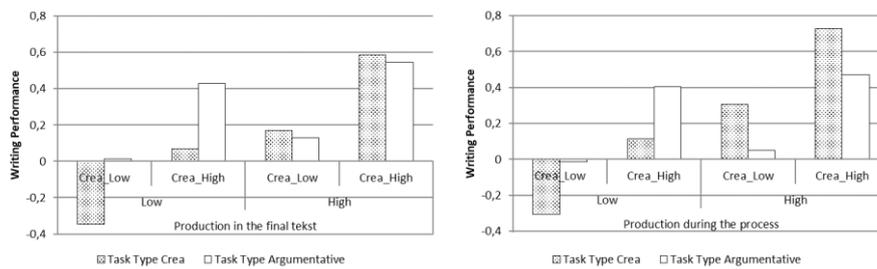
For Writing Behaviour, three out of ten variables explained variance in Writing Performance. Main effects were found for Production in the final text ($\beta = .31$) and Number of P-Bursts ($\beta = .23$) (see Table 7). For Production during the process, the effect was present in creative tasks ($\beta = .57$) but not in argumentative ones (ns).

4.4 Exploration RQ2. Do learner variables moderate the relation between writing behaviour and writing performance?

4.4.1 Affective writing attitude and creative ability

The effect of both learner variables on Writing Performance is positive: the higher the scores on the learner variables, the higher the scores on Writing Performance, for both text types. For Affective Writing Attitude β varies from .37 to .63, depending on the process variable in the model, and for Creative Ability β varies from .41 to .46. The combined effects of levels of Production in the final text and during the process and Creative Ability levels on Writing Performance are shown in Figure 4. For both Writing Behaviours, the higher the frequency, the higher the score for Writing Performance. For Production in the final text (Figure 4A) the effect of Creative Ability is additive, for both task types, while for Production during the process (Figure 4B) an interaction with Creative Ability levels was observed: the effect is stronger for creative tasks.

Figure 4. Effects of two Writing Behaviour variables and the additional effect of creative ability on writing performance, with scores one standard deviation below (Low) and above (High) the mean.



4.4.2 Writing is emotionally intense

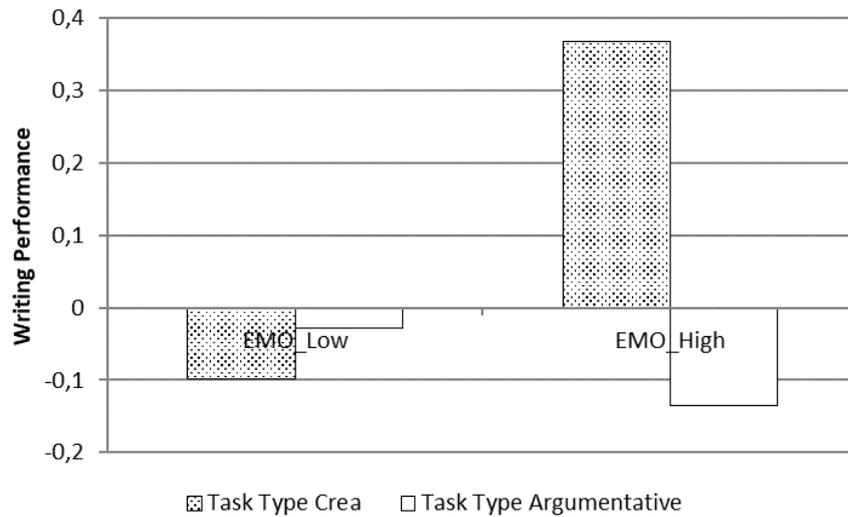
A third learner characteristic, the Writing is Emotionally Intense Belief, contributed to Writing Performance scores, but this differed between task types (Table 8). For Speed in the final text and the Revision Ratio, a significant effect was only observed for Creative Tasks (β_{Emo} varied from = .47 in Speed in the final text to .32 in Revision Ratio), while for other Writing Behaviours—the other speed variable, the pause variable, and the flow variable—the interaction effect of the Writing is Emotionally Intense Belief for Task Type was marginally significant ($.05 > p < .10$).

Table 8. Effects of writing behaviour and the writing is emotionally intense belief on writing performance

Model	-2 loglik	Models	Comparison			
			$\Delta\chi^2$	Δdf	<i>p</i>	
0. Cons	454.587	4				
1. + Speed in the final text	451.139	5	0 vs 1	3.448	1	.063
2. + Speed in the final text*Task type	450.599	6	1 vs 2	0.54	1	.462
3. + Writing is Emotionally Intense	441.569	7	2 vs 3	0.918	1	.338
4. + Writing is Emotionally Intense *Task Type	448.719	8	3 vs 4	8.112	1	.004*
0. Cons	467.198	4				
1. + Revision Ratio	466.902	5	0 vs 1	0.296	1	.586
2. + Revision Ratio*Task Type	465.498	6	1 vs 2	1.404	1	.236
3. + Writing is Emotionally Intense	465.232	7	2 vs 3	0.266	1	.606
4. + Writing is Emotionally Intense *Task Type	460.153	8	3 vs 4	5.079	1	.024*

This means that the higher students scored on the Writing is Emotionally Intense Belief, the higher the quality of their texts for creative tasks, but not for argumentative ones (see Figure 5).

Figure 5. Interaction effect of the writing is emotionally intense belief on writing performance



5. DISCUSSION

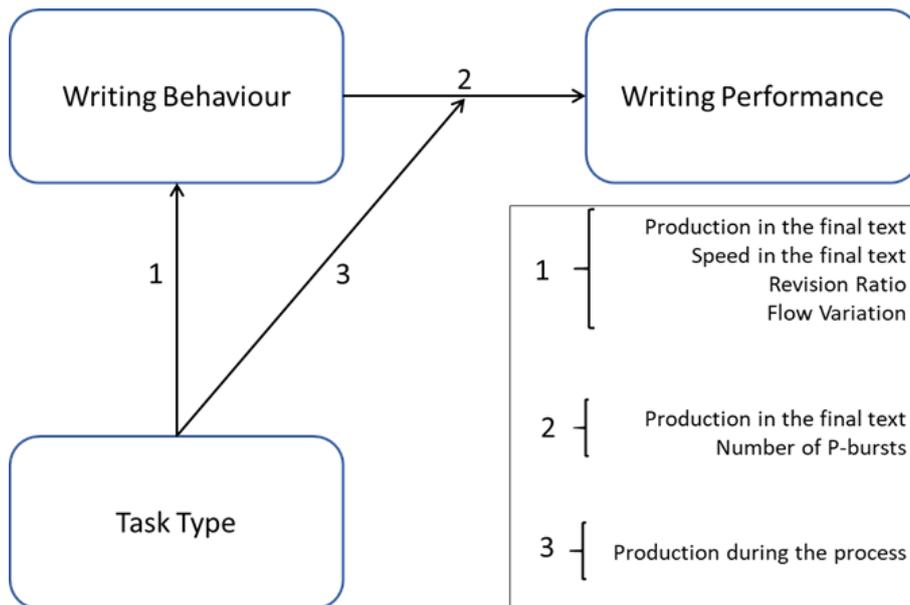
We investigated whether tenth and eleventh grade students' Writing Behaviour differed while writing creative versus argumentative texts and found that they do differ, in some respects. We also investigated which Writing Behaviour variables

affected Writing Performance, and found that Task Type moderates the effect. Additional, explorative analyses revealed that learner characteristics play a role. They correlate with Writing Behaviour and Writing Performance, moderate the effect of Writing Behaviour on Writing Performance and differentiate the moderator effect of Task type on the relation between Writing Behaviour and Writing Performance. Relevant learner characteristics were Creative Ability, Affective Writing Attitude and the Belief that Writing is Emotionally Intense.

5.1 Writing behaviour and writing performance in terms of text quality

Figure 6 shows the variables involved in creative writing processes and their relationship with Writing Performance.

Figure 6. Variables involved in creative writing processes and their relationship with writing performance. Numbers refer to variables in the running text.



First of all, we observed an effect of Task Type on four Writing Behaviours: Creative tasks resulted in more Production in the final text, Speed in the final text, a higher Revision Ratio, and less Flow Variation [1]. But only Production in the final text predicts Writing Performance, for both task types [2]: the longer the final text, the higher the score on text quality. Production during the process also correlates with text quality, but only for creative tasks, which indicates that text quality will be higher when students produce more text during creative tasks [3].

The number of P-Bursts also explains Writing Performance, but is not affected by Task Type [2]. Production in the final text and the Number of P-Bursts are not correlated (see Appendix D), which might indicate that these represent two different routes to text quality. This effect of Number of P-Bursts indicates that the more productivity cycles executed during the process, the higher the text quality score. Other P-burst characteristics (length, speed) did not predict text quality scores. However, the number of cycles correlates negatively with the length and speed of the bursts: the more bursts, the shorter and slower they are (Appendix D.) Such writing processes also show relatively more pause time ($r = .56$). This configuration might represent a process in which much text is produced, in many, relatively short and slow cycles.

We expected that Writing Performance improves if students write their creative and argumentative texts in different production cycles, with slower production in argumentative tasks and feedback loops (check and revise), and faster production and longer bursts in creative writing, with a forward drive, to generate fiction. Doyle (1998) as well as Csikszentmihalyi (1996) argued that fiction writers constantly alternate between immersion in the fictional world and critical judgement of the ideas they generate. There is constant monitoring of the production process at the point of inscription, which resembles the dual process model in which Galbraith and Baaijen (2018) proposed two different idea generation processes: a knowledge-constituting and a knowledge transforming process. When the writer is in the fiction realm, knowledge-constituting may be the dominant process: synthesizing unarticulated information from episodic memory and then articulating it in text. Keeping track of what is generated via synthesizing memory elements is a high-speed process, generating many alternating bursts. After such a (series of) burst(s), there is a little pause, at the point of utterance, not so much to repair text written so far, but rather to supply input to the memory system to support a coherent string of thought so that the writer can move forward. In argumentative writing, production speed is generally lower, there is more revision, and more variance in the flow than in creative tasks. This suggests that in such tasks the knowledge transforming process is dominant, in which writing is guided by rhetorical goals, which require attention to structure the information, reorganize ideas, and a more strategic search and evaluation of content, which slows down the production process. To test this claim, we need another approach than in the current study. From the correlational data (Appendix D) we might deduce that the correlational patterns of the four pause behaviours differ: the number of bursts is positively related to burst productivity in Creative tasks, but negatively in Argumentative ones; the process speed (number of bursts per minute) is not related to burst productivity in Creative Tasks, but is positively related to productivity in Argumentative Tasks.

The differences we observed between creative and argumentative writing processes, do not directly point to instructional actions. There are clear indications that the processes differ, and that productivity and probably production cycles are different. Creative writing could stimulate students to become more productive, and

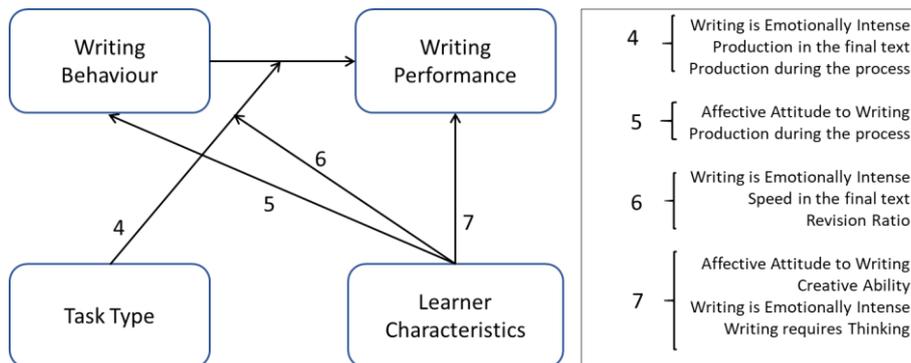
consistently productive during the process, which may support them to produce better texts, in creative and possibly also in argumentative tasks. Experimental studies in which creative writing is explicitly the focus of instruction may provide more answers in this respect.

To conclude, while creative writing tasks inherently seem to enhance text production and a steady fluent writing process, more research must be set up to explore the cyclical nature of fictional writing and the differences in cycles in creative and argumentative writing.

5.2 Learner variables

When we add learner variables to the model, the picture becomes rather complex. Figure 7 shows the four types of possible effects. We focus in this synthesis on the effects on Writing Performance, directly or via Writing Behaviour.

Figure 7. The effects of writing behaviour, task type and learner characteristics on writing performance. Numbers refer to passages in the running text



Quality of Writing Performance was directly related to two learner characteristics: a positive Affective Attitude to Writing and Creative Ability [7]. Indirect relations from Affective Attitude to Writing Performance run via Writing Behaviour [5]: students with a positive Affective Attitude to writing produce more text during the process and higher text production is related to better Writing Performance. These findings are in line with Amabile's (1983) componential theory of creativity in which motivational aspects play a central role. First, our learner characteristic 'Creative Ability' can be considered a creativity relevant process in Amabile's model: to be able to write good creative or argumentative texts, a certain level of creative thinking might be indispensable. Although we did not measure creative ability, we did measure the extent to which students perceived themselves as creative. Second, students with a positive attitude to writing, which qualifies as a measure of task motivation in

Amabile's model, wrote better texts. Our findings confirm Amabile's hypothesis that the extent to which creativity relevant processes and task motivation are present, influences the level of creativity. In our study students performed better on writing tasks when they were intrinsically motivated to write and when they considered themselves creative.

Two Writing Beliefs especially influenced the relevant Writing Behaviour in creative writing tasks: Writing requires Thinking and Writing is Emotionally Intense. The Belief that Writing is Emotionally Intense moderated the effect of writing Speed in the final text and the Revision Ratio [6], which contribute to Writing Performance in creative but not in argumentative tasks. This belief also strengthened the effect of tasks on Writing Behaviour [4], on text length and the number of strokes, in creative tasks. Both Writing Behaviours contribute to the quality of the resulting text [7]. It seems that students who believe that writing requires thinking and emotional involvement write with a higher level of flow and therefore produce more text. Furthermore, students who are relatively more emotionally involved when creating a text write significantly better creative texts, while this effect was not observed for argumentative tasks. This is in line with earlier findings. Lubart (2009) suggested that creative writing requires different kinds of thinking than writing in general, while Doyle (1998) argued that creative writers enter their own fiction world, which is hard to imagine without the writer's emotional involvement.

Actually, our findings show that the belief that writing requires emotional involvement partly predicts other writing processes and therefore better creative texts, while Affective Attitude to Writing predicts Writing Behaviours and therefore the quality of both creative and argumentative texts.

5.3 Implications

Our study may have implications for the writing curriculum in upper secondary education. As mentioned, creative writing is not part of the Dutch curriculum for upper secondary education, but there is currently a movement arguing for its inclusion. Since we found that students who write creative texts write more and faster, with fewer revisions and a more constant flow of writing, our research supports the reintroduction of creative writing. It seems advantageous to incorporate creative writing tasks in the curriculum, to stimulate text production, speed, and flow to help improve students' writing in general.

Regarding the learner variables, we found that it is crucial for students to experience that writing requires personal task investment. Amabile (1996, p. 252) stated that in education "Children should be encouraged to adopt an intrinsic motivation toward their work". Since creative writing requires a writer's personal involvement, practicing creative writing in secondary education might help stimulate students' motivation for writing.

5.4 Considerations

Our study has several limitations. Students all came from the same school, which, although not ideal, was also not a major issue, because students came from seven classes, taught by five different Dutch teachers, whose curriculum implementation varied. More importantly, none of the students had prior experience in creative writing. In addition, although the number of participants is relatively small for a quantitative study ($N = 20$), students each wrote eight texts and all writing processes were recorded, resulting in a large amount of process observations and product data per individual. Our choice to focus on validity across tasks instead of across participants had drawbacks in terms of statistical power, but not so much when relating writing behaviours to performance, as these scores represent a variety of tasks. But when relating the learner variables to the models, the findings cannot be seen as more than explorative, as we had to run many tests, with Type I errors as a real risk. Nevertheless, the relations found based on these analyses all seem fairly plausible and consistent.

Since participation was voluntary and during after school hours, one might assume that mainly students with a positive attitude to writing participated in the study. However, the small financial reward offered for participating, might also have appealed to students with other motives. Moreover, the data indicated that students' attitudes to writing varied, otherwise we would have observed no correlations between Writing Behaviour and Writing Performance.

Time constraints might also be seen as a limitation, as the tasks were timed tasks (20 minutes per task). For some individuals time pressure can be detrimental to creativity (Roskes et al., 2013), which may have affected their texts' creativity. Nevertheless, the time constraints also applied for argumentative texts, and our aim was to study the differences between these two task types, under fixed circumstances.

Furthermore, since weak writers show almost no variation in their writing processes (Braaksma et al., 2004), we chose to exclude relatively weak writers from our study, which had at least two consequences. First, the variation in writing behaviour and in writing performance between writers is reduced, which limits the chance to find relations between processes and text quality. Second, the results cannot be generalized to high school students in general. Nevertheless, the variability in writing behaviour and performance in the sample was large enough to detect relations. Moreover, we intend to carry out future intervention studies in the same age group, without selection based on prior writing performance, in which we will measure writing performance and writing behaviour again. This will enable us to test the presented relationship models on a larger and more varied sample.

One could also comment on the difference in task situations in creative and argumentative tasks. Creative tasks were preceded by a short warm-up task on divergent thinking, and students received explicit guidance to focus more on content and less on formal features of text like spelling, while no such tasks or instructions were provided for the argumentative tasks. However, we considered these additional

instructions for creative tasks necessary to stimulate students' creativity due to their relative unfamiliarity with creative tasks.

Finally, the Inputlog data reflect students' actions, not their thinking processes while writing. The big advantage of this method is its unobtrusiveness, but one might want to gain more insight in participants inner world, through stimulated recall using video recordings of the process. Given that this terrain is as yet rather unexplored, we chose to use the most unobtrusive way to gain initial insights in students' writing behaviours. These behaviours were found to be sensitive to task differences, which was for us a major finding, which we hope will trigger more studies in creative writing. In the present study we studied single writing process variables separately. Future studies may want to create task profiles, based on writing behaviour data, in which writing behaviours are combined in different configurations. It might be the case that different configurations are effective, as we indicated when we discussed the burst variables.

5.5 Conclusion

Our study has provided insight into students' creative and argumentative writing processes which may provide some directions for teaching writing in upper secondary education. Creative writing behaviour differs from argumentative writing behaviour: it enhances text production and writing flow. Introducing or retaining creative writing in language classes might offer students the opportunity to become proficient in these fluid and productive behaviours, which in turn can positively improve the quality of their texts.

Furthermore, it is striking that affective student characteristics seem to play a role. Students who consider themselves creative and have an affective writing attitude write better texts, regardless of text type. However, for creative texts these affective characteristics seem to contribute even more to explaining variance in text quality: creative text quality improves if students believe that writing requires personal commitment and/or believe in their own creative ability. Therefore, it might not hurt to reinforce this affectionate attitude towards writing. A way to accomplish this might be through creative writing, and in doing so, we might not only "...produce [...] more creative writers but also people who are more creative as they go about their lives (Sternberg, 2007, p.16) '.

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APPENDIX A

Example of a fictional creative writing assignment

Write a short captivating story of approximately 300 words. This is the beginning:

The three friends

One upon a time there were two friends who found a third. Liking no one better in the whole world, they vowed to live in one palace, sail in one ship, and fight one fight with equal arms. After three months they decided to go on a quest. 'What shall we seek?' they asked each other.

Copy the start and paste it into the Word file opened by Inputlog. Do not worry about spelling, grammar, font and the like while writing. It is mainly about the content of your story. Make it a fascinating and original story. Think of your peers as readers of your story.

You have 20 minutes. Good luck writing!

Example of an argumentative writing assignment

A letter to the newspaper

Look at the two short articles from *the Volkskrant* below. You can find the articles on the following pages. The first—shortened article— is an article from May 16 about 'smart children' and the second article is a shortened version of an interview from May 7 about game addiction. Choose one of the topics and read the article. Write a letter to the newspaper in which you respond to one of the articles. Write your letter to the editors of the newspaper and start your letter with 'Dear editors'.

State your opinion clearly and give arguments for your opinion. Give examples if necessary. Your letter is approximately 300 words. You have 20 minutes. Good luck writing!

APPENDIX B

Assessment instruction for all creative tasks:

Assess the texts for their overall quality. Pay attention to the intended purpose. For this text that was creativity.

Creativity probably overlaps with other criteria, such as wording, richness of imagery and choice of words, yet I ask you to judge the stories solely on your opinion of creativity. You are the expert and based on your expertise, you determine which text of each pair you find the most creative. You do not need to further substantiate or defend your assessment.

When assessing, you always indicate which of the two texts is the most creative. Choose text A or B.

Assessment instruction for all argumentative tasks:

Assess the texts for their overall quality. Pay attention to the intended purpose: is the text, for example, intended to convince or, on the contrary, to recruit people?

In assessing whether one text achieves the intended purpose more than the other, various criteria are likely to play a role to a greater or lesser extent, such as formulation, choice of words, content and organization. Nevertheless, I ask you to judge the texts solely based on your opinion of the overall quality. You are the expert and based on your expertise you determine which text of each pair you like best. You do not need to further substantiate or defend your assessment.

When assessing, you always indicate which of the two texts is the best if you consider the overall quality of the text, given the communicative goal. Choose text A or B.

APPENDIX C

Table 9. Table 9 presents M and Sd for all process variables for both task types. Effect size (Cohen's d): Crea vs Argumentative. See Table 4 for test indices.

Variables	Unit of measurement	Creative		Argumentative		Effect size
		M	Sd	M	Sd	
Production in the final text	Total number of characters in the final text	1,961.61	630.89	1,596.25	421.27	-.69
Production during the process	Total strokes produced during the process	1,804.56	502.49	1,634.00	412.95	-.37
Speed in the final text	Total number of strokes in the final text per number	286.00	94.82	226.99	76.18	-.69
Speed during the process	Average number of strokes produced during the writing process per minute	124.22	33.31	116.38	34.55	-.23
Revision Ratio	Revision ratio	1.16	0.16	1.06	0.17	-.61
Number of P-Bursts	Number of Pause-Bursts	41.53	16.50	41.18	16.38	-.02
P-Bursts per minute	P-bursts per minute	0.39	0.10	0.39	0.12	.01
Length of P-burst	Number of characters per P-burst	63.82	30.83	58.20	30.61	-.18
Proportion of pause time	Proportion over the total pausing time	0.23	0.10	0.25	0.11	.14
Flow Variation	Variation of number of keystrokes over the whole process	11.73	2.61	12.61	3.04	.31

APPENDIX D

Table 10 presents all correlations between process scores for Argumentative tasks (above diagonal) and Creative tasks (below diagonal). The correlation indicates the mean correlation across four tasks for each task type, based on 18 observations per task. The correlations between the two Production scores and the two speed scores are quite high (production .84 (Arg.) and .95 (Crea), speed .88 (Arg.) and .79 (Crea), but still leave ca 20-30% of the variance unexplained.

Table 10. Correlations between process variables per task type. Above diagonal correlations for Argumentative tasks, below for Creative tasks. ($r > .43$ is significant on $p < .05$)

	P1	P2	S1	S2	P1	P2	P3	P4	F	R
Production in the final text		0.84	0.54	0.62	-0.22	0.34	0.61	-0.50	0.18	0.09
Production during the process	0.95		0.35	0.59	-0.25	0.46	0.64	-0.66	0.24	-0.36
Speed in the final text	0.27	0.23		0.88	-0.64	0.31	0.72	-0.37	0.44	0.14
Speed during the process	0.58	0.60	0.79		-0.68	0.41	0.84	-0.48	0.56	-0.12
Number of P-Bursts	0.01	-0.04	-0.66	-0.63		-0.77	-0.80	0.46	-0.54	0.17
P-Bursts per minute	0.38	0.45	0.40	0.57	-0.73		0.79	-0.51	0.33	-0.24
Length of P-Burst	0.54	0.58	0.63	0.84	-0.74	0.90		-0.62	0.47	-0.15
Proportion of pause time	-0.51	-0.60	-0.43	-0.67	0.56	-0.72	-0.74		0.05	0.34
Flow Variation	0.14	0.15	0.49	0.49	-0.30	0.17	0.31	0.00		-0.25
Revision Ratio	0.19	-0.06	0.05	-0.15	0.27	-0.24	-0.18	0.31	-0.01	

APPENDIX E

Effect size

As requested by one of the reviewers we calculated the explained variances for the reported models. There is quite some discussion on what kind of calculations are valid in multilevel analyses, and the research design of the present study, with multiple tasks per individuals, and relatively few individuals, does not allow us to calculate regression weights in the model we presented in Figure 6. To provide the reader with some proxy indication of the explained variance, we correlated the predicted values, based on the models we report in the paper, with the observed scores. Squared correlations indicate the variance explained by the fixed parameter.

RQ1

For the four significant models (effect of task on processes): R2 varies from 3% (Production during the process) to 11% (Production in the final text, Speed in the final text)

RQ2

For the three variables that explain Text Quality: R2 varies from 4% (Proportion of pause time) to 14% (Production during the process),

Exploration 1: effect of Task and learner variable on processes

For the seven models reported, R2 varies from 7% (Affective/Speed in the final text) to 29% (Affective/Production in the final text).

Exploration 2: effect of learner variables on relation TQ

For the three models reported (Fig 6 in both versions, with LV Creativity): R2 varies from 15% (Proportion of pause time) to 24% (Production during the process).

For the two models reported in Table 8 (EMO): R2 is 7% for Speed and 5% for Revision.