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Role of Executive Functions in Improving Students' Narrative Text Writing Ability

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Abstract. This research was motivated by the low ability of students to engage in narrative writing. The purpose of this research was to examine the role of executive function in the process of students writing narrative texts and to investigate the contribution of executive function to various aspects of narrative text composition. The research method used in this study was a factorial analysis design to find out which executive functions contribute the most to the students' narrative writing skills. The participants of this study were 250 elementary school students with an age range of 9-12 years old. The data collection was carried out through several tests. The tests conducted assessed the transcription skills, language skills, and executive functions involved in the students' writing process, specifically using menggunakan CLAN (Computerized Language Analysis), Mean Length of T-unit in words (MLTUw), and the ERRNI test (Expression, Reception and Recall of Narrative Instrument). The research findings show that executive function contributes directly and indirectly to the students' narrative writing abilities. Aspects of the constraints encountered, updating, and planning contribute directly to both the long and short aspects of the text. In addition, the constraint and renewal aspects indirectly contribute to the length of the text, the level of complexity of the sentences, and the quality of the story content. The implication of this research is that a teacher must be able to optimize the implementing function, namely by planning, revising, and reviewing the students' abilities using various writing strategies and methods. The development of this executive function is very beneficial for students in relation to improving their writing skills, especially the writing of literary texts.

Keywords: executive function; writing ability; narrative text; factorial analysis design; constraints; updating and planning

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1. Introduction

Writing is a productive language skills. Writing skills are a process that also involves thinking processes, especially when organizing ideas or ideas into a single unit. Writing skills need to be directed by predetermined goals so then the writing is clear and directed (Hadianto et al., 2022; Roitsch et al., 2021). This executive function forms the basis of and supports the process of the writing skills. The previous research examining student writing development found that executive function is a self-regulating strategy or method that includes guiding and controlling the students' cognitive abilities during the writing process. Executive function is defined as the stages used to monitor the writing process, including planning, transcription, review, and improvement. Many studies have adopted this model theory as part of a pedagogical and executive function development in relation to their students' abilities (Baudouin et al., 2019; McKinney et al., 2020). In the early developmental stages of children's writing, executive function has a limited role due to the students' unstable and limited transcription and writing abilities. The writing process model consists of two main components, namely the transcription process and executive function. These two main components strongly support transcription and the working memory environment (Brown et al., 2021; Butterfuss et al., 2022).

The transcription process includes several aspects, including handwriting and the use of spelling. Executive function includes three stages, specifically planning, monitoring, and improvement. The text-making component includes the conversion of ideas into linguistic forms such as words, sentences, and texts. For writers who are adults or experts, this transcription provides the most dominant contribution because in this process, the writer optimizes the use of cognitive resources in their working memory. Beginner writers use the method of writing about what they know about a topic using limited executive functions, namely planning and revision, to avoid an excessive cognitive load. Writers of a young age will switch to knowledge transformation strategies when their writing skills are developing and their cognitive load decreases (Arterberry & Albright, 2020; Oddsdóttir et al., 2021). When this process occurs, the executive function of the writer will reach the highest level which facilitates the writer in arriving at a global context, good text structure, and being able to produce coherent texts. Currently, researchers have found that not only do high-level executive functions contribute to writing ability but low-level executive functions also contribute to the writing processes of students. The executive functions and their corresponding cognitive skills can be seen in Table 1.

The current research focuses on the role of executive function on an individual's ability to write narrative texts at both the macro- and microstructural levels. The difference between this study and previous studies is that the assessments focus on low and high-level executive functions based on neuropsychological tests. An assessment was also carried out looking into the students' ability to update, convert, and plan the writing process, as well as their transcription skills and use of language. The researcher proposed a hypothesis that the low and high level executive functions make different contributions at the macro- and micro-levels of text structure because the level of language used is different. In this research, the researcher formulated the problem, namely what the role is of low and high

level executive functions in relation to the students' ability to write narrative texts, at both the macro- and microstructural levels. The purpose of this study was to investigate the role of executive function in the students' narrative writing abilities and what aspects directly and indirectly contributed to the students' narrative writing abilities. Through this research, teachers can optimize the aspects that contribute the most to improving the students' writing skills.

2. Literature Review

2.1 Executive Functions and Writing Ability

The inhibitory component of the lower-level executive function contributed the most to the writing task, whereas shifting was the strongest component in terms of predicting the outcome of the report writing task. The previous research confirms that the low executive function of these inhibiting and shifting components is able to demonstrate the variable spelling and writing abilities of students in low grades (Chung et al., 2018; Cordeiro et al., 2020). The contribution of the lower-level executive functions to the writing process is difficult to interpret because the writing instructions are at the same grade level as th writing assignments. Thus, instructions are needed from different task classes, for example word and text classes, because the executive function may have a different contribution at each level. The executive function components of inhibition and shifting are able to facilitate the students in terms of enabling them to produce words, while high-level executive functions are able to facilitate the students in producing texts and making them.

Table 1. Executive functions and relevant cognitive abilities

Compatibility of cognitive abilities and executive functions		
Low-level Executive Functions	Inhibition	(1) Ability to select appropriate stimuli and block inappropriate stimuli (selective attention) (2) Ability to complete tasks when distracted (continuous attention) (3) The ability to block the blocking response (inhibition response)
	Update	Ability to update and store information in working memory
	Shift	The ability to divert the mind from the task to the mental students and vice versa
High-level Executive Functions	Ability to plan, solve problems, and reason	Ability to develop ideas, plan, and use strategies. Specific executive functions: planning setting ideas and goals, translating cognitive into linguistic form, reviewing, and revising

Several previous studies have attempted to explain the contribution of executive function in relation to the writing abilities of students. Previous research has explained that there are variables in executive function that can be used as part of the data analysis (Kornblith et al., 2020; Salas & Silvente, 2020). In addition, other studies were able to distinguish between the contributions of executive function through a series of limited tests (Hooper et al., 2020). However, most of the previous studies have not explained in detail how low-level executive functions contribute to the students' writing ability. In general, it is stated that the

contribution of executive function plays a role in controlling cognitive abilities during the writing process. For example, the inhibiting executive function component plays a role in inhibiting the use of words, where sentences that have lexical meanings do not match the text that they write. In addition, this executive function also plays a role in selecting the most appropriate set of words or phrases. In the process of writing, writers need to store text representations in their long-term memory. The content of this working memory must be updated to match the existing schemata in the working memory (Follmer & Sperling, 2019; Roald et al., 2021).

2.2 Composition and Evaluation of Narrative Text

There are two levels to a written text composition, namely microstructure and macrostructure. The microstructure includes words and sentences, while the macro structure is the text or discourse. Microstructural analysis is carried out at the level of productivity and complexity, while macrostructural analysis is carried out on the text's organization, coherence, structure (reasoning, part structure), and content (ideas) (Raphael-Greenfield et al., 2020; Wang, 2019). Based on Table 2, it can be interpreted that this macro- and microstructure is very closely related to the language used when producing the text. The productivity factor is related to words, complexity is related to sentences, and the macrostructure is related to the text (Price, 2020).

Table 2. Composition level of written text and language level as part of the performance assessment

Levels of composition	Language level	Evaluation
Micros	Word	Productivity
	Sentence	complexity
Macro	Text	Content and structure of the text

The assessment of writing ability at the level of both macro- and microstructures can be used to assess the differences in ability between individuals in terms of converting ideas into words, sentences, and texts. Competence when turning ideas into words does not necessarily represent the same ability of converting ideas into sentences and text. This difference in intra-individual ability explains that the process of producing text requires different processes and cognitive abilities at each language level. The low-level executive functions have differences, meaning that they have different functions in relation to writing skills at the higher level (Arterberry & Albright, 2020; Castillo et al., 2022). From this theory, the question arises as to how executive function contributes to the production of words, sentences and texts, and how executive function is an important factor that affects beginners' writing skills. Nonetheless, studies examining executive function according to the neuropsychology of low and high executive function are still rare and limited. Therefore, through this research, the researcher will reveal how the roles of low and high level executive functions affect the production of narrative texts at the levels of words, sentences, and texts.

3. Methodology

3.1 Research Design

The research method used in this study was a factor analysis design in order to reveal the role of executive functions in relation to an individual's ability to write narrative texts at both the macro- and microstructural levels (Beisly et al., 2020). This method was used because it was in accordance with the research objective to reveal the role of each component of executive function that contributes significantly, not significantly, directly, and indirectly to the ability to write narrative texts and to the micro-macro structure of the text. Through the factorial design analysis research method, all roles of each component of executive function were examined in order to determine their contribution to each text structure made by the students.

3.2 Participant

This research involved 250 elementary school students who were taken from three schools in the Sukabumi area of Indonesia. The gender ratio in the sample was 40% male and 60% female. The age of the participating students was in the range of 9-12 years old (SD=10.45). The socioeconomic status of the students was in the middle and high levels of class. The participants were selected using a purposive sampling technique, taking into account the criteria for writing ability and age range. The majority of the participants were bilingual with Sundanese as their first language and Indonesian as their second language. To maintain the influence of the diversity of language skills, the researcher made sure that the participants' language skills were at the same level. The participants were divided into two groups. An assessment was carried out relating to two components. The first component included nonverbal cognitive abilities, specifically handwriting fluency, and language skills. The second component was an assessment of the students' executive functions. The researcher taught two class sessions, namely the first reading assignment, and the task of writing narrative texts. The strength of the factorial design analysis method used was being able to investigate the factors or aspects of executive function that contribute significantly, indirectly, directly, and indirectly to the students' narrative writing abilities, while the weakness of this method was the discovery of emphasis in relation to finding quantitative data and the non-optimal findings that were qualitative in nature.

3.3 Research Instruments and Analysis

3.3.1 Narrative text analysis

To measure the students' ability to write narrative texts, the researcher used the expression, reception, and recall narrative instruments from Bishop (2004). This instrument was used to assess the composition of the students' narrative texts. The instrument consisted of two forms of fiction. The story was facilitated by pictures. The students were asked to make stories from the provided picture booklets, and the students were also given the opportunity to look at the entire booklet containing the pictures before starting to write their stories. Composition, duration of writing, and story length were not specified. Everything was left to the students until they had written a story as a whole describing the given picture booklet. The written narrative texts were analyzed using the analytical model adopted from MacWhinney (2006). The story text was divided into the main clause and subclause syntax. Narrative text analysis was carried out on its

structure, namely regarding the level of complexity of the main clauses and subclauses. Transcription was carried out by two researchers so then the agreement between the raters was analyzed. Based on the results of the analysis, the level of agreement of the researchers reached 97%. Macro- and microstructural analysis was also carried out on the students' written transcripts.

3.3.2 Productivity and syntactic complexity

The texts were assessed for length using the number of words. This was used as an assessment of the student's productivity microstructure. Counting the number of words was done using student narrative texts, applying CLAN (Computerized Language Analysis). This calculation can also be used to determine the level of reliability. The assessment of the microstructure of sentence complexity was carried out using the Mean Length of T-unit in words (MLTUw). Sentence complexity was calculated by dividing the number of words in the text by the number of T-units. This assessment was also carried out to test its reliability.

3.3.3 Narrative text story content

The contents of the text were used as the material for evaluating the macro structure of the narrative text. The content and coherence of texts were used by the researchers to assess the suitability of the semantic information in the texts and this aspect was also used for assessing the quality of the student texts. The researchers used the standard procedure of the ERRNI test (Expression, Reception and Recall of Narrative Instrument). This test consisted of the framework of 25 ideas inserted into the text. The ideas were strung together to form the components of the text structure. The method of assessment was carried out by giving 2 points for ideas that were intact when representing ideas in the text, and 1 point for ideas written incompletely or not yet clear. The maximum score was 50 if all ideas were intact. The assessment was carried out by two raters who identified the story content. If there was a disagreement between the assessors, a discussion was held. The student's writing transcript was divided in half with each assessor getting 50% of the transcript of each writing. Furthermore, 30% of the text transcripts were assessed by both raters to measure the level of inter-rater reliability. From the results of the assessment, a reliability value of 0.95 was found. According to this value, it can be said that the assessment instrument was reliable enough for use in this research.

3.3.4 Writing skills

The researcher assessed the students' writing skills according to the aspect of fluency when handwriting and their skills when using spelling in writing. The score was calculated according to the number of letters written by the students every 5 minutes. The reliability level for this test obtained a value of 0.70. The skill of using spelling was assessed based on the spelling in the students' writing starting from spelling and punctuation. The form of the assignment could take the form of words, sentences, and fuller texts. The maximum score for using spelling was 150. The reliability of the writing skill test was determined to be 0.93. According to this value, the reliability of this writing skills test met the criteria for use in this research.

3.3.5 language skills

There were several aspects used to assess the students' language skills including grammar, vocabulary, and sentence complexity. Grammar was assessed by assessing the Mean Length of T-unit in words (MLTUw) as well as looking at the level of sentence complexity during the writing process. Spoken language ability was assessed through the telling of stories using the ERRNI test, analyzed using CLAN, therefore it did not require a reliability test. Vocabulary skills were assessed using the Peabody Picture Vocabulary Test from Dunn (2005). For the oral language test, the students told stories orally to those in front of them, and the other students were asked to show pictures that matched what was being told. The maximum score for language skills was 205. The reliability level of the internal consistency was 0.95. This value met the criteria, meaning that this instrument was able to be used.

3.3.6 Executive function

The assessment of executive function assignments was carried out based on three important aspects of lower-level executive functions, namely inhibition, renewal, and transfer. The high-level executive functions of planning are linked to the written language of the test sequence. Multiple tasks were assessed to cover all aspects of executive functioning. The researchers used four tasks to examine the aspects of inhibition. The researchers used the Tea-Ch Sky Search (The Subtest of Everyday Attention for Children) to assess the aspects of selective attention. Selective attention was assessed by assessing the ability to control the speed of their writing in seconds. The number of words generated divided by the amount of time needed in seconds was used to get the selective attention score. The results of the reliability test of this task obtained a value of 0.85. For sustained attention, the researcher used the letter replacement task LDST (Letter Digit Substitution Task) from Jolles, Houx, Van Boxtel, and Ponds, (1995). The students were given a paper on which was written numbers 1-9 paired with letters. The students were asked to match the letters with the appropriate numbers within 80 seconds. The test obtained a reliability value of 0.90. The researchers used the Walk Don't Walk subtest (Tea-Ch Walk Don't Walk) and the Opposite Worlds Subtest (Tea-Ch Opposite Worlds) to measure the aspect of executive function inhibition. The Walk Don't Walk subtest was used by the researchers and involved cassettes. The researcher played and stopped the tape while the students did the writing assignment. The test was carried out to determine whether the students' concentration was hampered by the sound of music or not. The items assigned to be written during this test were 25 items with a total possible score of 25. The reliability level of this test was 0.75. In the Opposite Worlds subtest, the researchers showed the students keys containing numbers and letters. Next, the students were asked to name the pairs of numbers and letters that matched the keys as quickly and as many as possible. The reliability value for this test was 0.85.

The researcher used the intelligence scale from Wechsler (2004) to measure the students' updating abilities during the writing process. In this test, the students were asked to repeat the sequence of numbers and letters written by the researcher. If the sequence of letter and number pairs was correct, a score of 1 was given. A score of 0 was given if it is wrong. The total score for renewal ability using the Wechsler scale was 15 at maximum. The internal consistency of this

assessment was 0.80. To assess transferability, the researchers used the executive function test of Delis–Kaplan (2001). This test used the students' verbal fluency. In this test, the students were given a set of letters by the teacher and then tasked to say as many words as possible from the set of letters they were provided. The score was calculated according to the number of words generated in 1 minute. The reliability level of this assessment instrument was 0.80. To assess the students' cognitive flexibility abilities, the researcher used the tracking test adopted from Dellis (2001). In this test, the students were given paper with drawings of 32 circles made up of numbers and letters. In this test, the students were asked to draw lines with interesting patterns between the numbers and circles. The score for this assessment was the time it took to complete the task. The reliability level of this task was 0.90. The executive functions of high-level planning were assessed using the Tower of London method from Shallice (1982). The students were assigned to make towers using discs according to the configuration contained in the book. The students had to reach the goal, minimize their movements, and pay attention to the disc movement. The total score was calculated by adding up the scores for each tower (maximum score of 30). The internal consistency reliability of this assessment was 0.85.

3.4 Data Analysis

The data analysis used several methods including descriptive analysis to determine the average value, standard deviation, minimum and maximum values based on aspects of the narrative text, and various assessments. Correlation analysis was carried out to determine the relationship between the executive functions when writing narrative texts. Next, path analysis was carried out to determine the aspects of executive function involved in writing narrative text. Lastly, regression analysis was carried out to determine the aspects that contribute directly and significantly in relation to the interaction between the components of executive function and the aspects of the ability to write narrative texts.

4. Results

4.1 Descriptive analysis

The researcher presented the descriptive statistics according to the results of the assessment of the students' narrative transcription skills and language skills in Table 3. In addition, the researcher also presents the results of the analysis of the main components of the executive function used as formative tasks and their relationship with the abilities that support the overall ability to write narrative texts in the same table. The analysis was carried out to reveal the role of the main components of executive function using a sample of 250 students using orthogonal rotasu (varimax). The researcher used an eigenvalue greater than one of the main components to summarize the data. The eigenvalues and percentage of variance were calculated based on the three factors before the orthogonal rotation was carried out. The eiganvalue data and percentage of variance for the three factors are presented in Table 5. The three factors used were able to represent 56% of the total variance of the data. The rotational load factor of the eight criteria is described in Table 6. Factor consistency was carried out using the criteria for loading with a value of ± 0.50.

Table 3. Results of the analysis of narrative text, transcription skills, language skills, and the students' executive functions

n= 250	Mean	SD	Min.	Max.
The written narrative				
Text length	256.40	114.60	70	548
Syntactic complexity	7.40	1.40	2.70	11.30
Story content	28.45	6.75	13	50
Transcription				
Handwriting fluency	180.02	40.61	65	275
Spelling	96.54	17.90	45	130
Language skills				
Grammar	7.70	1.40	4.90	11.70
Vocabulary	125.20	10.30	98	156
Executive functions				
Tea-Ch Sky Search	4.50	1.60	3	13.88
Tea-Ch Walk Don't Walk	15.03	5.45	1	25
Tea-Ch Opposite Worlds	35.50	5.12	25	50
LDST	36.60	8.30	15	50
WISC-IV-I Digit Span	13.13	2.40	6	24
D-KEFS-Letter Fluency	16.60	5.30	5	30
D-KEFS-TMT	124.70	40.52	40	253
TOL	16.25	3.70	7	26

From the results of the principal component analysis, executive function was assessed from various factors. There are three factors that serve as the basis for the analysis of the executive function. The first factor included Tea-Ch Walk Don't Walk and Tea-Ch Opposite, LDST, and D-KEFS-TMT. Tea-Ch Walk Don't Walk and Tea-Ch Opposite were used to assess the students' response barriers. LDST was used to assess the students' continuous attention abilities and D-KEFS-TMT was used to assess the students' cognitive flexibility. The second factor included WISC-IV-I Digit Span, Tea-Ch Sky Search, and D-KEFS-Letter Fluency. The WISC-IV-I Digit Span assessment was used to assess the students' working memory updating abilities. The Tea-Ch Sky Search assessment was used to assess the students' selective attention. The D-KEFS-Letter Fluency assessment was used to assess the fluency of the students' phonemic verbal skills. The third factor included TOL and D-KEFS-TMT. TOL was used to assess high-level executive functions, namely the ability to plan and the strategic organization of the text. D-KEFS-TMT was used to assess the students' cognitive flexibility. From the results of the main component analysis, several important findings were found. In the first factor, the results of the analysis show that the assessment focused on attentional tasks, so it was believed to be an inhibiting factor. Furthermore, the

second factor focused on the tasks that assessed working memory renewal abilities and selective attention. The second factor is also referred to as the contribution of the executive function to the quality of the students' narrative text writing.

Table 4. Correlation between narrative writing assignment, transcription ability, language ability, and the executive function assessment

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Text length	1													
Syntactic complexity	.35**	1												
Story content	.60**	.45**	1											
Handwriting fluency	33**	.25*	.31**	1										
Spelling	.30**	.26*	.20	.28**	1									
Grammar	.16	.50**	.25*	.06	.16	1								
Vocabulary	.20	.04	.28**	.13	.15	-.13	1							
Tea-Ch Sky Search	.30**	-.00	.16	.25*	.05	.010	.08	1						
Tea-Ch Walk Don't Walk	.27*	.20	.20	.18	.25*	.13	.03	.03	1					
Tea-Ch Opposite Worlds	.26*	.23*	.11	.30**	.15	-.010	.03	.010	.38**	1				
LDST	.45**	.13	.26*	.21	.24*	.08	-.03	.14	.16	.44**	1			
WISC-IV-I Digit Span	.16	.25*	.16	.18	.43**	.15	-.010	.15	.20	.17	.11	1		
D-KEFS-Letter Fluency	.20	.08	.17	-.05	.06	.03	.07	.15	.16	.23*	.18	.16	1	
D-KEFS-TMT	.08	.12	.18	.20	.20	.12	.16	.15	.27*	.50**	.26*	.30**	.20	1
TOL	.08	.06	.16	-.02	-.04	.08	.07	.04	.08	.04	.15	.08	-.02	.35** 1

Table 5. The percentage of variance and eigenvalues of the three factors used for assessing executive function

Factor	Eigenvalue	Percent of variance	Cumulative percent
First	3.40	30.0	30.0
Second	1.10	14.7	45.6
Third	1.09	13.8	58.7

Table 6. Main components of executive function with an orthogonal rotation

	Factor		
	1	2	3
Tea-Ch Walk Don't Walk	.70	-.09	.05
Tea-Ch Opposite Worlds	.85	.14	.03
LDST	.60	.25	.08
D-KEFS-TMT	.60	.28	.55

WISC-IV-I Digit Span	.23	.50	.25
D-KEFS-Letter Fluency	.40	.53	-.27
Tea-Ch Sky Search	-.13	.85	.05
TOL	.03	.02	.93

Furthermore, the factor that serves to distinguish high and low executive function planning was found to be the third factor. The third factor is also called planning because through the measurement of the third factor, it can be seen that there is an intercorrelation relationship between moderation and the students' cognitive flexibility factor. From the results of the principal component analysis, it was found that the tasks representing the executive functions of the D-KEFS-TMT and D-KEFS-Letter fluency shifts contained three assessment factors. Referring to the results of the previous studies, it was found that the executive function of low grade students between shifting, inhibiting, and renewal cannot be separated. Therefore, this research also analyzed the sample in this way. Shift factors are built on the basis of the inhibition and renewal of lower-level executive functions. Broadly speaking, the research findings indicate that there is a significant difference in score between low-level executive functions according to the aspects of inhibition and, renewal, and high-level planning executive functions. The standard aspect score from the principal component analysis was found to be M=0, and the standard deviation value=1. These values were used to analyze the inhibition, renewal, and planning variables in the correlational, regression, and path analysis processes.

4.2 Correlational analysis

After organizing the series of executive functions into three factors, the next analysis was to examine the relationship between the differences in writing and transcription skills, language skills, and executive functions. The students' writing ability was assessed according to the aspects of productivity and sentence complexity. Productivity includes the number of words. The aspect of sentence complexity was analyzed at the microstructural level, while at the macrostructural level, it included the analysis of both the writing content and ideas. The results of the descriptive analysis on the writing steps are presented in Table 3. The relationships between the narrative writing steps and transcription skills, as well as the relationships between language skills and executive functions, are presented in Table 7. The results of the analysis found that text length has a significant correlation with the smoothness of the writing transcription process, as well as the use of spelling in relation to the inhibition and renewal factors. In addition, a significant correlation was found between sentence complexity and fluency in transcription and the use of written spelling. In addition, a correlation was found between grammar and inhibition factors. Furthermore, a correlation was found between content and the students' handwriting fluency, vocabulary, and grammar skills at the macro-structural level.

Table 7. The relationship between narrative tasks and the students' transcription skills, language skills, and executive functions

	Microstructure Text length	Syntactic complexity	Macrostructure Story content
Transcription			
Handwriting fluency	.32**	.25*	.33**
Spelling	.30**	.26*	.20
Language skills			
Vocabulary	.20	.04	.28**
Grammar	.16	.46**	.25*
EF			
Inhibition	.30**	.25*	.20
Updating	.30**	.08	.20
Planning	-.02	.06	.15

4.3 Regression analysis

Subsequent analysis was carried out using multiple regression analysis to determine the role of executive function in improving the students' narrative writing skills after analyzing their transcription skills and language skills. Based on the results of the correlation, the researcher used three multiple regression methods to find out which aspects were related to the length of the narrative text, the content, and the complexity of the sentences used. First, the researcher analyzed the students' transcription abilities, then they analyzed their language skills. The results of the analysis were then examined against the executive function to determine its contribution to the students' writing abilities. The summary of the results of the multiple regression analysis is presented in Table 8. In predicting the length of the students' writing, the students' language skills contribute 15% of the unique variance, specifically the fluency of the students' transcription skills and their ability to use correct spellings. This can be seen from the standard beta score of each variable. There was not found to be a significant number of variants in relation to the students' language skills. The unique variance of executive function was found to be 10% in relation to transcription and language ability. The number of major variants is represented by the inhibition and renewal factors.

Table 8. The results of the regression analysis for the aspects of text length, sentence complexity, and narrative text content

	Microstructure Text length		Syntactic complexity		Macrostructure Story content	
	R2	b	R2	b	R2	b
1. Transcription	.15		.010		.13	
Handwriting		.25*		.18		.30**
Spelling		.24*		.22*		.13
2. Language skills	.17		.26		.22	
Vocabulary		.15		.03		.27**
Grammar		.12		.43**		.25*

3. EF	.25	.30	.25	
Inhibition		.25*	.16	.14
Updating		.22*	-.04	.13
Planning		-.05	.00	.010

The students' transcription ability contributed 10% of the variance of the aspect of sentence complexity. The aspect of using spelling was the most significant contributing aspect. Next, the researcher added the language ability variable. From the results of the model analysis, it was found that the model contributed 17% of the total variance. The variances are generally represented by grammatical variables. Executive function does not contribute significantly to the sentence complexity variable. Content and transcription skills contribute 10% of the content variance, described by the student's writing fluency variable. Language ability contributes 10% of the total variance. Vocabulary and grammar were found to be significant predictor variables. From the results of the analysis, it was found that there was no executive function domain that contributed significantly to the narrative text content variable.

4.4 Path analysis

Based on the results of the regression analysis, executive function does not contribute to the aspects of sentence complexity, content, transcription ability, and language skills. It can therefore be concluded that the ability of transcription hinders the contribution of executive function in the text writing process. This happens because the transcription process used is not automatic and because the transcription process itself uses up cognitive resources. The next analysis performed was path analysis. Path analysis was conducted to determine the effect of executive function on the ability to write narrative text using transcription skills as a medium. The suitability of this path analysis model was assessed using the Chi square and the suitability index methods. The value of the Chi square test results must be more than 0.05 in order to meet the suitability index criteria. To test whether the path model met the criteria, the value of the suitability index, the suitability index of comparison, the suitability of goodness, and the conformity index had to have a result norm of more than 0.90, while the root value of the mean square error of approximation (RMSEA) must be less than 0.09. From the results of the path analysis, there were several variables that did not contribute significantly (v2 = 12.02, p = .15, df = 8; RMSEA = .10, GFI = 2.00, NFI = .93, CFI = .99, AGFI = .91). Several findings from among the path analysis results, including the inhibition and renewal factors, contribute directly to the length of the narrative text but do not contribute to the complexity and content of the narrative text.

5. Discussion

This study aimed to investigate the contribution of executive function on the ability to write narrative texts among low grade students. Several breakthroughs in this research were carried out to uncover new findings. The researcher proposed the hypothesis that low and high level executive functions make different contributions at the macro and micro levels of text structure because the level of language used is different. The new finding in this study is that executive function contributes directly and indirectly to the students' narrative writing abilities. Constraints, updating, and planning aspects contribute directly to both

the long and short aspects of the text. In addition, the constraints and renewal aspects indirectly contribute to the length of the text, the level of complexity of the sentences, and the quality of the story content. A series of tests were performed using standardized neuropsychological measures of high and low level executive function. The task of writing narrative text was found to be in accordance with student development. The analysis of the narrative composition was used as the basis for assessing writing ability. Through this study, the researchers focused on compositional analysis at the macro- and microstructural levels. The research findings show that executive function contributes to the composition of narrative texts in two ways. The first way is where the inhibition and renewal aspects contribute directly to the length of the narrative text which encourages the writer to produce more words even though they have poor transcription and language skills. This is in line with the theory that the number of words in this text is used as a criterion for fluency in writing and can also be used as a predictor of writing quality (Olmos-ochoa et al., 2021; Wubalem, 2021). The findings for inhibition and updating the contributions to text quality were reflected in the students' ability to select the relevant lexical meanings and their ability to update their working memory while writing narrative texts (Bock et al., 2021; Hawamdeh et al., 2023).

If the ability to write fluently is not good, it will cause the ability to choose a language to use to be slow. In addition, the writing process will be disrupted, especially the speed of writing and text production, which will become shorter. Another finding is that the inhibition and renewal factors also contribute indirectly to the aspects of length, sentence complexity, and content, especially in the composition of words, sentences, and texts. In addition, the factor of understanding and updating is also able to become an intermediary linking between these variables. This finding is reinforced by the theory that the process of writing and transcription require a greater amount of cognitive power and executive function in support of the ability to write narrative texts (Baudouin et al., 2019; Hadianto et al., 2021a). The relationship between the factors of inhibition, renewal, and writing fluency represent the role of executive function in coordinating multiple aspects during the writing process, inclusive of planning motor skills, orthography, the integration of motor orthography and processing speed. Good writing skills will help divert the students' cognitive abilities so then they are more optimally used in producing texts at every level, namely words, sentences, and texts together (Dawilai et al., 2019; Mateos et al., 2020).

The inhibiting and renewal factors contribute in the same pattern to the composition of narrative texts, namely by making a direct contribution to the words and an indirect contribution to the words, sentences, and texts. This is based on the theory that the high-level executive function of planning can support the process of text production and reading comprehension (Choy & Cheung, 2022; Wubalem, 2021). However, the findings of this study are contrary to this theory, as there was no contribution found due to planning on any level of narrative text composition. This happened due to several factors. First, high-level and complex cognitive abilities develop in late childhood and will develop rapidly in early adolescence. Second, the low grade students were not able to develop their planning skills in the writing process. This is in accordance with the theory that novice writers do not yet have sufficient enough planning skills for them to be

used during text production (Fung & Chung, 2020; Hadianto et al., 2021b). So if students already have the ability to write automatically, their cognitive abilities can be used optimally due to high-level planning factors. These reasons are valid according to the research finding that the planning factor in the composition of narrative texts does not contribute either directly or indirectly. However, previous research has confirmed that the students' planning ability was found to contribute to the low grade exposition text writing assignment.

6. Conclusion, Limitations and Recommendations

Executive function contributes directly and indirectly to the students' narrative writing abilities. Aspects of constraints, updating, and planning contribute directly to the long and short aspects of the text. In addition, the constraints and renewal aspects indirectly contribute to the length of the text, the level of complexity of the sentences, and the quality of the story content. This research also confirms that executive functions contribute at various levels of the narrative text composition, starting with words, sentences, and texts. The implication of this research is that a teacher must be able to optimize the implementing function, namely by planning, revising, and reviewing the students' abilities through various writing strategies or methods. The strategy that can be used to optimize the executive role is to train the students by having them write various types of text. Teaching writing should be guided, starting from the stages of planning ideas, giving the students the opportunity to improve and re-assessing their writing once the writing is finished. This strategy can train the students' executive functions so then the students' sensitivity to errors and the students' writing skills increase.

Research on writing skills reveals the role of executive function which acts as a self-control when using planning, improvement, and review strategies. The executive function was examined to find the right intervention to optimize the role of executive function itself as part of supporting the students' writing abilities. This study had several limitations, including that the students who were the participants were from the early or lower classes. This means that further research is needed to reveal the role of high-level executive functions in the middle or high classes. This research is limited to macro and microstructures which focus on three assessments, namely productivity, sentence complexity, and story content, so further research is needed to examine other components such as lexical diversity, the organization of ideas and reasoning. Another limitation is that this study only focuses on the ability to write narratives by hand, meaning that the cognitive abilities are divided into two, namely writing by hand and writing organization, which is not optimal. Further research is expected to involve a larger number of samples so then structural equation model analysis can be used in order to reveal more. This research needs to be conducted on middle and high class students to determine the differences in executive function in adult students.

7. References

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