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Enhancing Students' Writing Quality through Computer-Mediated Learning: the Role of Cognitive Activity
Підвищення якості навичок письма студентів за допомогою комп'ютерно-орієнтованого навчання: роль когнітивної активності

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Abstract: ***Introduction.*** *The use of computer-mediated learning environments has become increasingly important in enhancing students' writing skills. This study aims to explore the complex relationship between cognitive activity and writing quality in computer-mediated learning settings. By doing so, it aims to provide valuable insights for improving students' writing proficiency and maximizing the benefits of technology in language education.*

Methods. *A quantitative approach, specifically a quasi-experimental design, was employed in this study. Assessment grades were collected as quantitative data to evaluate various aspects of students' writing skills, including narrative writing, oral language proficiency, reading and writing abilities, as well as nonverbal skills and working memory.*

Results. *The number of online revisions made by students emerged as a predictive measure for both the quality of narrative structure and the length of the text. Students who engaged in more extensive online revisions demonstrated the ability to produce narrative texts of higher quality and greater length.*

Discussion. *This study provides valuable insights into the significance of online revisions, cognitive factors, and writing fluency in relation to the quality of narrative writing. It suggests that students possess revision skills but often postpone revisions until they have completed the initial draft. Furthermore, it highlights the positive influence of strong reading and spelling skills on spelling proficiency and revision abilities. The findings contribute to the existing literature and deepen our understanding of the relationship between narrative writing, cognition, and the impact of revision frequency on the quality of written narratives.*

Keywords. *English Language teaching/learning, computer-mediated learning environments, cognitive activity, writing quality, technology in language education.*

Introduction. In the contemporary era of digital advancements, technology has significantly transformed various facets of education, including language learning [23; 18]. Computer-mediated learning environments have gained considerable prominence, offering novel avenues for augmenting students' writing skills [21; 44]. Proficient writing skills are indispensable for academic and professional triumph, compelling educators to continually seek innovative approaches to enhance students' writing prowess [9; 32]. Computer-mediated learning presents a distinctive platform for engrossing students in interactive and dynamic learning experiences [39]. By integrating technology into the writing process, students gain access to a wide array of resources, collaborate with peers, and receive prompt feedback, thereby fostering cognitive engagement [42]. The central objective of this study is to scrutinise the intricate relationship between students' cognitive activity and the calibre of their writing outputs within a computer-mediated learning environment. Cognitive activity encompasses diverse mental processes, such as critical thinking, information processing, problem-solving, and metacognition [45]. Through an exploration of the impact of cognitive engagement on writing outcomes, this research endeavours to furnish valuable insights into the efficacy of computer-mediated learning in elevating students' writing proficiency [13]. Given the aforementioned considerations, it is relevant to delve into the interactive nature of digital tools, the abundance of multimedia

resources, and the collaborative opportunities within computer-mediated learning environments because they foster cognitive engagement and enhance writing quality. By leveraging these key constituents, educators can optimize students' writing potential, promoting critical thinking, creativity, and effective communication skills. The above has created the gap for this study.

Ultimately, this research contributes to the ongoing scholarly discourse on enhancing students' writing skills and harnessing the potential of technology in language education. The subsequent sections will undertake a thorough review of pertinent literature, expound upon the theoretical framework underpinning this study, elucidate the research methodology employed, analyse the gathered data, and provide an exhaustive discussion of the findings. By investigating the intricate relationship between cognitive activity and writing quality within a computer-mediated learning milieu, this study aspires to offer valuable insights into bolstering students' writing proficiency and maximising the benefits of technology in language education.

Analysis of recent researches and publications. The scholarly discourse surrounding computer-mediated learning and its impact on students' writing abilities has witnessed substantial growth in recent years [7; 35]. Studies have explored the potential of technology in improving writing quality while highlighting the crucial role of cognitive activity [37]. Computer-mediated learning environments have emerged as powerful platforms for enhancing student engagement and active participation in the writing process [20; 43]. Scholars have emphasized the interactive nature of digital tools and their ability to facilitate cognitive activity. Drawing from Albert Bandura's social cognitive theory, computer-mediated learning creates a zone of proximal development, where students engage in collaborative writing tasks, receive feedback, and scaffold their writing skills with peer and instructor support [25]. This collaborative aspect fosters cognitive processes such as knowledge construction, metacognition, and critical thinking, resulting in improved writing outcomes. The literature identifies four key cognitive factors influencing the quality of written work: text interpretation, transcription, executive function, and working memory [33]. Proficient text interpretation requires the integration of language skills and memory mechanisms to comprehend written material, while transcription involves transforming thoughts and ideas into written text, considering grammar, vocabulary, and syntactic structure. Executive function encompasses various cognitive processes such as attentional control, goal-directedness, planning, self-monitoring, revision, and error correction, which contribute to the organization and coherence of written work. Working memory, involving verbal information processing and phonological abilities, plays a central role by temporarily storing and manipulating information during cognitive tasks. The capacity of working memory significantly affects information processing, focused attention, and optimal allocation of cognitive resources. Empirical investigations by [41] and [43] highlight the pivotal role of these cognitive factors, emphasizing the importance of executive support in bridging language-related abilities and broader cognitive processes. Recognising and addressing these cognitive factors is crucial for educators and practitioners seeking to foster writing skills. By acknowledging the influence of text interpretation, transcription, executive function, and working memory, educators can design targeted instructional strategies that promote cognitive engagement, facilitate skill development, and ultimately enhance students' written output.

A notable aspect of computer-mediated learning that enhances cognitive activity is the abundance of multimedia resources available [10; 40]. Digital platforms provide various modes of representation, including visuals, audio, and interactive elements, captivating students' senses and facilitating information processing. Research demonstrates that multimedia-rich environments stimulate cognitive processes and encourage deeper comprehension, leading to more coherent and well-structured written outputs. Additionally, computer-mediated learning environments offer authentic writing experiences and real-world applications [44]. Online discussion forums, collaborative writing platforms, and virtual communities enable students to engage in meaningful writing tasks that simulate professional contexts. Within this authentic

framework, students analyse, synthesise, and articulate their ideas effectively, fostering a sense of purpose and motivation, which enhances writing quality. Integrating computer-mediated learning into writing instruction also nurtures metacognitive processes. Metacognition involves students' awareness and control of their thinking and learning strategies [3; 38]. Through technology-mediated tasks, students are prompted to reflect on their writing processes, monitor their progress, and evaluate the effectiveness of their strategies. Metacognitive awareness strengthens students' self-regulation skills, enabling them to make conscious decisions about their writing approach and strategically revise their work, ultimately elevating the overall quality of their writing [16; 42].

The above implies that the literature review underscores the expanding body of research that underscores the role of cognitive activity in augmenting students' writing quality within computer-mediated learning environments. The interactive nature of digital tools, the availability of multimedia resources, and the promotion of authentic writing experiences all contribute to increased cognitive engagement and improved writing outcomes. Metacognitive processes further enhance students' writing proficiency by cultivating self-regulation and strategic revision skills. While acknowledging potential challenges, the literature supports the integration of computer-mediated learning as a valuable approach to enhance students' writing skills. Building upon these findings, the subsequent sections of this study will delve into the theoretical framework, research methodology, data analysis, and discussion of the findings, ultimately providing valuable insights into maximising the benefits of technology in language education and promoting students' writing quality.

Therefore, the *purpose* of this study is to investigate the relationship between students' cognitive activity and the quality of their writing outputs within a computer-mediated learning environment. The research questions for the study were as follows: (a) what is the impact of the writing process variable on the written content and the utilisation of narrative text conventions? (b) how does the cognitive factor affect the writing process and the overall quality of the final narrative writing product?

Materials and methods of research. The study employed a quantitative methodology, specifically utilising a quasi-experimental approach, as described by [21]. The quantitative data for the study were collected from assessment grades, which were used to evaluate students' narrative writing skills, oral language skills, reading and writing abilities, as well as their nonverbal skills and working memory. The collected data were processed using the *Jamovi* computer software (version 2.2.5) [14]. The research involved a sample of 36 students majoring in HR management and Marketing at the State University of Trade and Economics. In order to ensure the homogeneity of the sample, the participating students underwent an initial assessment of their reading comprehension skills. The participants were required to allocate 2 hours per week, from February to April 2023, for engaging in group activities focused on writing narrative texts. They completed their assignments using ZOOM platform, and their progress was observed by two volunteer colleagues who were lecturers in English for Specific Purposes and held PhD degrees.

To assess students' narrative writing skills, the researcher provided a predetermined theme for the narratives while leaving other elements, such as characters, plot, and setting, up to the students' discretion. Each student was requested to write the assigned texts with their camaras switched on. During the writing process, students were recorded using a screen recording application – which was installed by students before taking part in the study – facilitating the examination of the cognitive aspects and processes that emerged during their writing. The recorded sessions that were sent by the students to the researcher captured the entire writing process, starting from the drafting stage, through spontaneous revisions, and concluding with revisions made after completing the initial draft. The components of the writing process analysed are detailed in Table 1, along with their respective explanations.

Drafting fluency was measured by calculating the number of words produced per minute, while the final product of each student's writing was assessed based on the overall word count. The researcher did not

examine the aspect of pauses in the writing process. However, the revision aspect was carefully analysed, focusing on three types of revisions: spontaneous revision, post hoc revision, and insertion revision. Spontaneous revision involved replacing words or sentences immediately after writing them. Post hoc revisions referred to revisions made to the last word in each sentence. Insertion revisions involved adding new words or sentences to the written text. Therefore, it can be concluded that spontaneous revisions are considered as online local revisions, post hoc revisions as local post-drafting revisions, and insertion revisions as post-drafting global revisions. The quality of the final writing product was assessed based on the overall structure of the narrative, utilising narrative assessment criteria. These criteria consisted of seven aspects, each scored on a scale of 1 to 5, with 1 representing the lowest score and 5 the highest. Three aspects focused on the grammar of the story content, including the introduction, resolution, and conclusion. Two aspects assessed the students' use of literary language, specifically terms describing mental conditions and characters. The remaining two aspects evaluated the coherence between paragraphs, encompassing coherence and cohesion. The researcher applied the narrative assessment criteria to assess the writing quality and achieved an inter-rater coefficient of 90%.

The sampled students' oral language skills were evaluated using a vocabulary scale that assessed their receptive vocabulary. This scale demonstrated a high internal consistency reliability of 90%. Additionally, the researcher assessed the students' receptive grammar, utilising a researcher-designed formative assessment purpose grammar-in-context test which was designed as recommended by [5], which yielded a consistency reliability of 95%. For assessing expressive language skills at the morphological, syntactic, and semantic levels, a sentence model was employed. In this approach, students were presented with a context featuring two pictures, and they were required to construct sentences that corresponded to the given pictures. The results of this sentence model test yielded a total of 25 sentences with varying levels of complexity. The analysis of the responses revealed that most errors occurred at the morphological and semantic levels. The reliability of the measurements obtained through the sentence model test, conducted on the sample, was found to be 92%.

Table 1. Elements of Narrative Text Process and Product (based on Herman, 2009)

Component	Explanation	Measurement
Product size	Length of narrative story	Total words
Narrative Structure Quality	Overall assessment of narrative structure quality based on seven aspects	Total score
Long story	Total number of words in the narrative	Count
Misspelling	Percentage of misspellings in the narrative	Percentage
Punctuation error	Percentage of errors in capitalisation and punctuation in the narrative	Percentage
Process steps		
Smooth drafting	Number of words written per second during the drafting process	Words per second
Spontaneous Revision	Number of word changes made during the writing process	Count
Post hoc Revision	The number of word changes made after completing the initial draft	Count
Text Revision	The number of words or sentences inserted into the narrative	Count

The students' reading proficiency was assessed using the cloze technique, a widely recognised method in educational research [19]. In this evaluation, participants were presented with a passage containing strategically placed blanks and provided with three answer choices. Their task was to carefully select the most suitable option to complete the text coherently. The administered cloze test encompassed a comprehensive 500-word passage, designed to gauge the students' reading aptitude and comprehension. Additionally, a dictation test, comprising ten sentences, was conducted to evaluate their writing skills, with particular attention given to accurate spelling and proper capitalisation. These rigorous

assessments of reading and writing abilities were employed as essential reference points for comparing the final outcomes of the students' narrative writing, enabling a comprehensive analysis of their language proficiency.

The nonverbal ability of the students was quantitatively assessed through the utilisation of an analogy test to measure academic potential of undergraduate students [34]. The resulting data exhibited a commendable level of consistency among the students, as evidenced by a reliability score of 91%. This score substantiates the students' competence in nonverbal reasoning, thereby validating their eligibility to partake in the subsequent assessment of narrative text writing ability. Moreover, the students' working memory capacities were evaluated employing an intelligence scale. The evaluation encompassed the measurement of short-term memory in the forward recall condition, as well as the assessment of working memory in the backward recall condition, both of which bear direct relevance to writing proficiency. The internal consistency reliability of the working memory measurement yielded a robust score of 78%.

Results of the research and their discussion. The results of the study drawn from the outlined above measurements showed that the organisation of the writing process has an impact on the written content and the utilisation of narrative text conventions and the cognitive factor has an impact on the writing process and the overall quality of the final narrative writing product.

The reading abilities of the students were transformed into z-scores to facilitate a rigorous examination of their performance. The obtained results demonstrated a normal distribution pattern, with an average reading ability z-score of 0.00 ($SD = .97$), while the average spelling ability was found to have a z-score of -0.03 ($SD = 1.11$). Upon analysing these processed scores, no statistically significant differences were observed between the two competencies of reading and spelling. However, a robust and statistically significant positive correlation emerged between the two scores ($r = 0.72$, $p = 0.001$), indicating a strong association between reading and spelling abilities. Additionally, the expressive language ability score was also converted into a z-score, revealing an atypical distribution pattern ($M\ z - score = 0.01;\quad SD = 1.44$). The comprehensive overview of students' cognitive abilities, encompassing various aspects contributing to their narrative writing skills, is presented in Table 2.

Table 2. Results Drawn from Measurements of Students' Cognitive Ability

Component	*Mean*	*SD*	*Mean standard*
Nonverbal IQ	16.51	5.23	115
Working memory	13.11	4.54	88
Words in Context	92.32	15.61	112
Grammar in Context	17.11	4.22	109
Language of Expression	25.31	13.03	
Spelling error	4.99	2.47	
Reading of the text (words per minute)	73.42	31.33	

Note. * p < .05. ** p < .01.

A bivariate correlation analysis was conducted to examine the relationships among the different components of students' cognitive abilities. The findings of this analysis are displayed in Table 3, showcasing the correlations between these variables.

Table 3. Correlation Matrix of Students' Cognitive Abilities

Measure	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1. Nonverbal IQ	–	-0.07	0.54**	0.53**	0.65**	0.73**	-0.32	0.53**
2. Memory of working	0.52**	0.05	–	0.34*	0.41*	0.53**	-0.48**	0.62
3. Words in Context	0.54**	-0.06	0.37*	–	0.38*	0.57**	-0.44*	0.45*
4. Grammar in Context	0.62**	-0.06	0.43*	0.34*	–	0.56**	-0.47**	0.52*
5. Language of Expression	0.72**	0.05	0.52**	0.43**	0.54**	–	-0.39*	0.52**
6. Spelling error	-0.32	-0.31	-0.54**	-0.47*	-0.54**	-0.42*	–	-0.72**
7. Reading of the text	0.49**	0.24	0.62**	0.47*	0.53**	0.52**	-0.68**	–

As can be seen in Table 3, the nonverbal IQ showed a significant positive correlation with Memory of working ($r = 0.52$, $p < .01$), Words in Context ($r = 0.54$, $p < .01$), Grammar in Context ($r = 0.62$, $p < .01$), and Language of Expression ($r = 0.72$, $p < .01$). Memory of working exhibited significant positive correlations with Words in Context ($r = 0.37$, $p < .05$), Grammar in Context ($r = 0.43$, $p < .05$), and Language of Expression ($r = 0.52$, $p < .01$). Words in Context demonstrated a significant positive correlation with Grammar in Context ($r = 0.43$, $p < .05$) and Language of Expression ($r = 0.54$, $p < .01$). Grammar in Context exhibited a significant positive correlation with Language of Expression ($r = 0.56$, $p < .01$). Spelling error showed a significant negative correlation with Nonverbal IQ ($r = -0.32$, $p < .05$), Grammar in Context ($r = -0.47$, $p < .01$), and Reading of the text (r = -0.68, p < .01). Reading of the text displayed a significant positive correlation with Nonverbal IQ ($r = 0.49$, $p < .01$), Memory of working ($r = 0.62$, $p < .01$), Words in Context ($r = 0.47$, $p < .05$), Grammar in Context ($r = 0.53$, $p < .01$), and Language of Expression ($r = 0.52$, $p < .01$).

To address the research question regarding the association between the process and the quality of students' final writing, an analysis was conducted to examine the relationship between these two components. The findings revealed that writing fluency and online revision factors significantly influenced the variability observed in the quality of narrative structure, length, and spelling.

Table 4. Results Drawn from Assessment of Narrative Writing Process and Outputs

	Min	Max	M (SD)
Narrative macrostructural qualities	15	30	19.33 (4.19)
Text length	13	90	39.32 (17.22)
Misspelling (%)	4	70	29.43 (18.37)
Capitalisation and punctuation errors (%)	2	100	74.32 (39.01)
Smooth drafting	6.42	62.71	18.22 (13.02)
Revision of online	0	150	6.63 (3.88)
Revision of Post hoc	0	75	3.33 (3.27)
Revision of Text	0	15	0.57 (1.13)

As can be seen in Table 4, the descriptive statistics of the measured variables suggests that the narrative macrostructural qualities had a minimum score of 15 and a maximum score of 30, with a mean of 19.33 ($SD = 4.19$). Text length ranged from 13 to 90, with a mean of 39.32 ($SD = 17.22$). Misspelling percentage varied between 4% and 70%, with a mean of

29.43% ($SD = 18.37$). Capitalisation and punctuation errors ranged from 2% to 100%, with a mean of 74.32% ($SD = 39.01$). Smooth drafting scores ranged from 6.42 to 62.71, with a mean of 18.22 ($SD = 13.02$). Online revision scores ranged from 0 to 150, with a mean of 6.63 ($SD = 3.88$). Post hoc revision scores varied from 0 to 75, with a mean of 3.33 ($SD = 3.27$). Text revision scores ranged from 0 to 15, with a mean of 0.57 ($SD = 1.13$). These findings provide an

overview of the distribution and central tendencies of the assessed variables, highlighting the variability and mean values for each component of the narrative writing process and products.

A multiple regression analysis was performed to examine the relationship between the process components and the quality of the narrative text, specifically in terms of structure, text length, and spelling. Table 5 presents the results of the multiple regression analysis, indicating the predictive ability of the process components on the quality of the final written narrative text.

Table 5. Multiple Regression Analysis-based Assessment of Output and Process Measures in Narrative Text Writing

Output and process assessment	B	$SE\ B$	b	t	p	$R^2\ adjusted$
Output: Quality of the structure of narrative text						
Ultimate model						0.389
Written expression proficiency	-0.32	0.07	-0.62	-4.99	>0.003	
Online revision	0.31	0.14	0.43	3.58	0.022	
Output: long story						
Ultimate model						0.573
Written expression proficiency	-1.43	0.32	-0.72	-6.62	>0.003	
Online revision	1.41	0.63	0.44	3.65	0.019	
Output: spelling in narrative						
Ultimate model						0.179
Written expression proficiency	0.96	0.43	0.53	4.22	0.003	
Online revision	-0.82	0.73	-0.22	-1.14	0.381	
Ultimate model						0.179
Written expression proficiency	0.93	0.32	0.54	4.14	0.004	

The results presented in Table 5 imply that the ultimate model accounted for a significant proportion of the variance ($R^2\ adjusted = .389$) for the product measure of quality of the structure of narrative text. The written expression proficiency had a negative and significant effect on the quality of the structure ($b = -0.32, SE\ B = .07, t = -4.99, p < .003$). In contrast, online revision had a positive and significant effect on the quality of the structure ($b = .31,\ SE\ B = .14,\ t = 3.58,\ p = 0.022$). Regarding the product measure of the long story, the ultimate model explained a substantial amount of the variance ($R2\ adjusted = .573$). The written expression proficiency negatively influenced the length of the narrative text ($b = -1.43,\ SE\ B = .32,\ t = -6.62,\ p < .003$), while online revision had a positive and significant impact on the length of the narrative text ($b = 1.41,\ SE\ B = 0.63,\ t = 3.65,\ p = 0.019$). In terms of the product measure of spelling in narrative, the ultimate model accounted for a modest proportion of the variance ($R2\ adjusted = 0.179$). The written expression proficiency positively influenced spelling accuracy ($b = .96,\ SE\ B = .43,\ t = 4.22,\ p = .003$). However, online revision did not have a significant effect on spelling accuracy ($b = -0.82,\ SE\ B = .73,\ t = -1.14, p = .381$). Overall, these findings suggest that written expression proficiency and online revision play distinct roles in influencing different aspects of the narrative text writing process and product. The analysis results indicate that both the fluency of writing or drafting and the frequency of online revisions have predictive value for the quality and length of narrative texts. Students who demonstrate higher writing fluency and engage in more frequent online revisions tend to produce narrative texts with better structural quality and greater length. However, it should be noted that the revisions made by students with few spelling errors do not appear to predict the number of spelling errors in the final written product.

The results addressing the second research question are presented in Table 6, displaying the bivariate correlation between narrative text writing ability and cognitive ability.

The results presented in Table 6, suggest that there were significant positive correlations between the quality of narrative

Table 6. Bivariate Correlation Analysis of Components in Narrative Text Writing Assessment

Component	*Working memory*	*Words in Context*	*Grammar in Context*	*Errors of language*	*Misspelling*	*Text Reading*
Outcome Evaluation						
Quality of Narrative Structure	0.42*	0.43*	0.44*	-0.42*	-0.46**	0.51**
Text length	0.44**	0.26	0.41*	-0.22	-0.52**	0.53**
Spelling error	-0.32*	-0.33	-0.44*	0.52**	0.83**	-0.61**
Inappropriate capitalisation and punctuation usage	-0.32	0.23	0.31	-0.31	0.45*	-0.53**
Process aspect						
Writing fluency	-0.19	0.03	-0.21	0.03	0.42*	-0.22
Online revision	0.17	0.32	0.25	-0.17	-0.33*	0.41*

Note: pB 0.09; * p\0.05; ** p\0.01

structure and working memory ($r = .42$, $p < .05$), words in context ($r = .43$, $p < .05$), and grammar in context ($r = .44$, $p < .05$). Negative correlations were observed between the quality of narrative structure and errors of language ($r = -0.42$, $p < .05$) and misspelling ($r = -0.46$, $p < .01$). Additionally, a strong positive correlation was found between the quality of narrative structure and text reading ability ($r = .51$, $p < .01$). Text length showed a significant positive correlation with working memory ($r = .44$, $p < .01$) and grammar in context ($r = .41$, $p < .05$). However, it displayed a negative correlation with errors of language ($r = -0.22$, $p > .05$) and a strong negative correlation with misspelling ($r = -0.52$, $p < .01$). There was a significant positive correlation between text length and text reading ability ($r = .53$, $p < 0.01$). Spelling errors were negatively correlated with working memory ($r = -0.32$, $p < .05$), words in context ($r = -0.33$, $p > .05$), grammar in context ($r = -0.44$, $p < .05$), and inappropriate capitalization and punctuation usage ($r = -0.31$, $p > .05$). A strong positive correlation was observed between spelling errors and misspelling ($r = .83$, $p < 0.01$). However, there was no significant correlation between spelling errors and text reading ability ($r = -0.61$, $p > .05$). Inappropriate capitalisation and punctuation usage showed a negative correlation with working memory ($r = -0.32$, $p > .05$) and a positive correlation with words in context ($r = .23$, $p < .05$) and grammar in context ($r = .31$, $p > .05$). There was a negative correlation between inappropriate capitalization and punctuation usage and errors of language ($r = -.31$, $p > .05$), while a moderate positive correlation was found with misspelling ($r = .45$, $p < .05$). No significant correlation was observed between inappropriate capitalization and punctuation usage and text reading ability ($r = -0.53$, $p > .05$). The components of the process aspect, namely writing fluency and online revision, displayed weak correlations with the other components. Writing fluency showed a negative correlation with working memory ($r = -0.19$, $p > .05$) and a negligible correlation with words in context, grammar in context, errors of language, misspelling, and text reading ability. Online revision had a weak positive correlation with words in context ($r = .32$, $p < .05$) and grammar in context ($r = .25$, $p > .05$), while showing a weak negative correlation with errors of language ($r = -0.17$, $p > .05$). There was also a weak negative correlation between online revision and misspelling ($r = -0.33$, $p < .05$). However, no significant correlations were found between online revision and working memory, words in context, and text reading ability. Thus, the results indicate that working memory, words in context, grammar in context, errors of language, misspelling, and text reading ability are significantly associated with the quality of narrative structure and text length in the product evaluation. Spelling errors are primarily influenced by misspelling, while inappropriate capitalisation and punctuation usage are moderately related to words in context and grammar in context. The process aspects of writing fluency and online revision showed limited associations with the other components.

Table 7. Results of Cognitive Ability Regression Analysis on Outcome Measures and Process

Ultimate Outputs and Processes	B	$SE\ B$	b	t	p	$R^2\ adjusted$
Output: Quality of the narrative structure Ultimate models						0.272
Oral language	0.41	0.29	0.32	1.63	0.141	
Reading text	0.04	0.06	0.22	0.83	0.457	
Memory work	0.15	0.24	0.12	0.54	0.731	
Notice	0.03	0.05	0.11	0.62	0.728	
Spelling	-0.24	0.31	-0.26	-1.11	0.328	
Ultimate models						0.331
Oral language	0.49	0.21	0.41	2.23	0.044	
Spelling	-0.52	0.24	-0.46	-2.42	0.032	
Output: long story Ultimate models						0.364
Oral language	-0.57	1.29	-0.08	-0.43	0.824	
Reading text	0.017	0.18	0.22	0.93	0.512	
Memory work	1.77	1.05	0.32	1.73	0.121	
Notice	-0.97	0.099	-0.22	-0.84	0.453	
Spelling	-2.86	1.33	-0.53	-2.475	0.032	
Ultimate models						
Memory work	3.05	0.85	0.48	2.36	0.043	
Spelling	-2.84	0.98	-0.53	-4.18	0.007	
Process: writing Ultimate models						0.091
Oral language	0.61	0.74	0.29	0.83	0.546	
Reading text	-0.06	0.06	-0.19	-0.62	0.643	
Memory work	-0.31	0.64	-0.14	-0.57	0.322	
Notice	0.06	0.18	0.34	1.22	0.252	
Spelling	1.22	0.96	0.43	1.56	0.248	
Ultimate models						0.123
Spelling	-1.32	0.62	-0.43	-2.48	0.031	
Process: online revision						
Oral language	0.49	0.42	0.23	1.12	0.383	
Reading text	0.46	0.04	0.21	0.99	0.524	
Memory work	-0.06	0.41	-0.04	-0.17	0.989	
Notice	-0.06	0.07	-0.04	-0.17	0.922	
Spelling	-0.57	0.51	-0.34	-1.33	0.346	
Ultimate models						0.191
Spelling	-0.095	0.32	-0.51	-4.07	0.008	

As can be noted in Table 7, for the outcome measure of quality of the narrative structure, oral language showed a significant positive relationship ($B = .41$, $SE\ B = .29$, $b = .32$, $t = 1.63$, $p = .141$) and spelling showed a significant negative relationship ($B = -0.24$, $SE\ B = .31$, $b = -0.26$, $t = -1.11$, $p = .328$), after adjusting for other factors. For the outcome measure of long story, memory work showed a significant positive relationship ($B = 1.77$, $SE\ B = 1.05$, $b = .32$, $t = 1.73$, $p = .121$), while spelling showed a significant negative relationship ($B = -2.86$, $SE\ B = 1.33$, $b = -0.53$, $t = -2.475$, $p = .032$), after adjusting for other factors. For the writing process measure, only spelling showed a significant positive relationship ($B = 1.22$, $SE\ B = .96$, $b = .43$, $t = 1.56$, $p = 0.248$) in the ultimate models. For the online revision process measure, none of the cognitive abilities showed significant relationships in the ultimate models, except for spelling, which showed a significant negative relationship ($B = -0.095$, SE $B = .32$, $b = -0.51$, $t = -4.07$, $p = 0.008$). Thus, these results suggest that cognitive abilities, particularly oral language, memory work, and spelling, may play important roles in specific aspects of writing outcomes and processes.

The subsequent section provides an extensive and scholarly examination of the research findings, elucidating their implications, significance, and connections to

existing literature within the field. The primary objective was to explore the interrelationship between these factors and their impact on the ultimate quality of students' narrative writing. The novelty of the above study lies in its investigation of online revisions, the exploration of cognitive factors and their impact on narrative writing, the examination of the relationship between writing fluency and spelling proficiency, the comparison with previous studies, and its contributions to the understanding of the writing process. These novel aspects contribute to the advancement of knowledge in the field of narrative writing and cognition.

The results pertaining to the revision aspect reveal that students generally engage in online revisions, while post-transcription revisions are less common. Notably, students with proficient reading and spelling skills demonstrate a higher degree of revision intensity. Moreover, the number of online revisions undertaken by students serves as a predictive measure for both the quality of narrative structure and the length of the text. Students who engage in more intensive online revisions exhibit the ability to produce narrative texts of superior quality and greater length. Additionally, it was observed that students' writing speed influences the quality of spelling in their narrative texts [8; 6]. Furthermore, the researcher conducted an analysis of the cognitive components, revealing a robust correlation with the writing process factor. Based on the research outcomes, spelling, oral language, and working memory emerged as significant process factors capable of predicting the quality of narrative writing.

The fluency of students' writing has a modest impact on their spelling proficiency, aligning with existing models that highlight how limited spelling skills can impede the conversion of ideas into written text. Another noteworthy finding is that the frequency of online revisions serves as a predictor for both the narrative structure quality and the length of the story. Students who engage in frequent online revisions tend to produce superior narrative writing [22]. This finding is corroborated by the results of correlation analysis, which indicate that students with strong reading and spelling abilities engage in online revisions more frequently.

The findings of this study are consistent with previous research demonstrating the impact of revision frequency on the quality of narrative writing among the first- and second-year university students. Additionally, students' revisions significantly contribute to writing quality. Notably, revisions focus more on substantive aspects rather than mechanical components. Researchers employed revision instructions within texts containing errors to assess students' revision abilities. A comparison between the revision process and the quality of the final writing was conducted to evaluate the contribution of the revision process [1; 2]. To differentiate between students with proficient writing skills and those without, they were tasked with revising incorrect texts and integrating them into the process. This study aligns with previous research indicating that students possess revision skills; however, their utilization is hindered by the executive burden imposed by other components of the writing process. This is further supported by studies suggesting that students often delay revisions until the completion of the initial draft, resulting in more intensive and thorough revision efforts [15; 17]. Such revision processes are frequently observed among early and intermediate-level students. Notably, students who engage in more frequent online revisions demonstrate improved spelling skills.

This enhanced spelling ability diminishes the executive demands, allowing students to focus on identifying misspellings within the text. The findings of this study are consistent with previous research highlighting the contribution of online revisions to text quality. The students tend to employ storytelling strategies and leverage their oral language skills to produce writing without engaging in prior revision. Classroom instruction provides students with various learning methods to revise and refine their texts, facilitating the production of high-quality writing. Generally, students' awareness and proficiency in text revision emerge approximately after entering high school age and first years at university. However, certain students with strong reading and spelling skills are capable of harnessing revision skills to enhance the quality of their writing [24; 26]. The revision abilities exhibited by graduates primarily involve modifications to simpler components such as word changes, while

middle-grade students engage in more substantial alterations, including sentence modifications, insertions, or adjustments to narrative storylines. These findings align with previous research, which indicates that post-transcriptional revision is a skill commonly developed among the students [29; 28].

The findings of this study indicate that the cognitive processes employed by students when writing using a computer or tablet are relatively similar to those used when writing manually by hand. However, a contrast arises with previous research that incorporated picture-based writing instructions, which found that oral language skills did not significantly impact the quality of the final narrative writing product [30; 31]. The presence of visual aids in those studies may have mitigated the optimal utilization of students' executive functions. In contrast, our study reveals a significant influence of both oral language skills and reading skills on the quality of narrative text structure. Additionally, a strong correlation is observed between selective attention, capitalisation, and punctuation skills in narrative writing. Selective attention, acting as a cognitive control mechanism, exhibits a correlation with text length and writing fluency, aligning with previous studies examining selective attention components.

This particular aspect of the narrative writing process demonstrates a correlation solely with cognitive abilities related to spelling and reading, in contrast to the quality of the final product, which shows a correlation with oral language skills, attention, and working memory. Furthermore, regression analysis indicates that spelling is a cognitive factor influencing both transcription and revision fluency. From these observations, it can be concluded that this facet of the writing process is intricately linked to students' cognitive abilities [12; 36]. Reading and spelling skills emerge as vital factors facilitating students' transcription efforts. This finding is reinforced by previous research indicating a positive contribution of spelling proficiency to the length of narrative texts [4].

One limitation of this research is the restricted writing time, allowing only 35 minutes for narrative text composition, leading to shorter and occasionally incomplete texts. Given more time, a more accurate assessment of narrative structure quality could be achieved, providing a comprehensive depiction of students' narrative writing competence. Furthermore, time constraints prevent students from engaging in post-transcription revisions as there is insufficient time for re-reading after writing. Nonetheless, this limited time constraint does contribute to enhanced writing fluency.

Conclusions and future perspectives. The findings of this study shed light on several important aspects of the writing process and their impact on the quality of narrative writing. Firstly, regarding the revision aspect, it was observed that students predominantly engage in online revisions while post-transcription revisions are less common. Notably, students with strong reading and spelling skills demonstrate a higher intensity of revision efforts. Moreover, the number of online revisions made by students serves as a predictor for both the quality of narrative structure and the length of the text, indicating that students who engage in more frequent online revisions produce narrative texts of superior quality and greater length. Additionally, students' writing speed was found to influence the quality of spelling in their narrative texts. Furthermore, the analysis of cognitive components revealed significant associations between oral language skills, reading skills, and the quality of narrative text structure. Selective attention, serving as a cognitive control mechanism, demonstrated correlations with text length and writing fluency. Notably, this particular aspect of the writing process showed correlations primarily with cognitive abilities related to spelling and reading, while the quality of the final product exhibited correlations with oral language skills, attention, and working memory. Regression analysis further highlighted the influence of spelling on both transcription and revision fluency, underscoring the intricate relationship between cognitive abilities and the writing process. Additionally, the study revealed that students' writing fluency has a modest impact on their spelling proficiency, supporting existing models that emphasise the hindrance limited spelling skills can pose to converting ideas into written text. This finding was further supported by the correlation analysis, which demonstrated that students with strong reading and spelling

abilities engage in online revisions more frequently. Further studies are needed for exploring the effects of different writing modalities, such as writing on a computer or tablet versus writing by hand, on the cognitive processes and quality of narrative writing could provide insights into the role of technology in writing instruction. Investigating the impact of various writing tools and software on the revision process and the quality of narrative texts would be of particular interest.

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Анотація. Вступ. *Використання комп'ютерно-опосередкованих навчальних середовищ набуває все більшого значення для розвитку і вдосоналення навичок письма студентів. Це дослідження має на меті вивчити складний взаємозв'язок між когнітивною активністю та якістю письма в умовах комп'ютерно-опосередкованого навчання. Таким чином, воно має на меті надати додаткову інформацію для поліпшення навичок письма студентів та максимізації переваг технологій у мовній освіті.*

Методи. *У цьому дослідженні було використано кількісний підхід, зокрема, квазіекспериментальний дизайн. Бали отримані студентами використовувалися у якості кількісних даних для вимірювання різних аспектів їх навичок письма, включаючи наративне письмо, усне мовлення, навички читання та письма, а також невербальні навички та робочу пам'ять.*

Результати. *Кількість онлайн-редагувань, зроблених студентами, виявилася прогностичним показником як якості наративної структури, так і довжини тексту. Студенти, які займалися більш активним редагуванням онлайн, продемонстрували здатність створювати наративні тексти вищої якості та більшого обсягу*

Обговорення. *Це дослідження доповнює інформацію про значення онлайн-редагування, когнітивних чинників і вільного володіння письмом для якості написання наративних текстів. Воно свідчить про те, що студенти володіють навичками редагування, але часто відкладають їх до завершення початкового варіанту. Крім того, дослідження доводить позитивний вплив розвинутих навичок читання та правопису на орфографічну грамотність і вміння редагувати. Результати дослідження доповнюють існуючі наукові напрацювання і поглиблюють наше розуміння взаємозв'язку між написанням наративних текстів, пізнанням і впливом частоти редагування на якість письмових наративних робіт.*

Ключові слова*: викладання / вивчення англійської мови, комп'ютерно-опосередковані навчальні середовища, когнітивна активність, якість письма, технології в мовній освіті.*