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THE RELATIONSHIP BETWEEN SLEEP DURATION AND YOUNG CHILDREN'S CREATIVITY

EVIDENCE FROM MONGOLIAN DICTATION TASKS AMONG FIRST-GRADE STUDENTS

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Abstract

Sleep plays a fundamental role in children's cognitive development, memory consolidation, attention, and learning processes. During the early stages of formal education, adequate sleep is particularly important for supporting the development of essential academic competencies, including language processing, information retention, and written expression. Sufficient sleep may be associated with better dictation performance, reflected in higher spelling accuracy and fewer writing errors. Although an expanding body of research has demonstrated associations between sleep and children's cognitive and academic functioning, the relationship between sleep duration and specific aspects of early writing performance remains insufficiently investigated, particularly within the context of Mongolian-language education. This research gap highlights the need to examine whether individual differences in sleep duration are associated with variations in spelling accuracy and dictation performance among Mongolian first-grade students.

Objective: This study aims to examine the relationship between sleep duration and young children's writing performance, with particular attention to spelling accuracy and dictation errors among first-grade students in Mongolia. Using Mongolian-language dictation tasks, the study explores whether differences in sleep duration are associated with variations in students' written language performance.

Methods: A quantitative, observational research design was employed, involving an initial sample of 28 first-grade students. Participants completed a Mongolian-language dictation assessment consisting of 25 words. Individual student identification codes and dictation scores were recorded. Descriptive statistical analysis was conducted using 27 valid observations, with one missing score. The preliminary analysis focused on mean performance, standard deviation, score distribution, and individual differences. The proposed inferential analyses include Pearson or Spearman correlation, independent-samples comparisons, and linear regression using IBM SPSS Statistics to examine the association between sleep duration and dictation performance.

Results: Preliminary descriptive findings indicated a mean dictation score of 18.26 out of 25 (SD = 6.74), with a median of 21 and a score range of 4–25. These findings demonstrate considerable variation in writing performance among the participating students. The relationship between sleep duration and dictation accuracy, including its association with the frequency of spelling errors, remains subject to further statistical examination using matched individual sleep-duration data.

Conclusion: This study provides an empirical framework for investigating the potential relationship between sleep duration and early writing performance in Mongolian primary education. By examining dictation accuracy as a measurable indicator of written language proficiency, the research seeks to contribute to a better understanding of how children's sleep patterns may be associated with their early academic development. The findings may offer useful implications for parents, educators, and primary education policymakers concerning the importance of healthy sleep habits during the early stages of formal schooling.

Keywords: Sleep Duration, Children's Cognitive Development, Early Writing Performance, Mongolian Dictation, First-Grade Students, Spelling Accuracy, Dictation Errors, Sleep Quality, Language Learning, Memory Consolidation, Academic Performance, Primary Education, Children's Sleep Patterns, Literacy Development, Cognitive Functioning.

1. Problem Statement

Despite the recognized importance of sleep in childhood development, the relationship between sleep duration and specific language-based academic outcomes remains an area requiring further investigation. Although previous research has established associations between sleep and children's cognitive functioning and academic achievement, less attention has been given to how sleep duration relates to particular components of early writing performance, especially spelling accuracy and dictation outcomes. In particular, there is a need for further context-specific empirical evidence concerning whether differences in sleep duration are associated with spelling accuracy among Mongolian first-grade students.

Dictation performance provides a useful means of examining children's early writing development because it requires the integration of several cognitive and linguistic processes. Students must listen to spoken language, process phonological information, retain verbal input in working memory, retrieve appropriate linguistic and orthographic representations, and reproduce words accurately in written form. Successful performance therefore depends not only on acquired language knowledge but also on cognitive processes such as attention, information retention, and auditory processing. Since these processes may be associated with children's sleep patterns, sleep duration represents a potentially relevant factor in understanding individual differences in dictation performance.

However, students may demonstrate substantially different levels of performance even when completing the same dictation task under similar classroom conditions. Such variation raises an important research question: Could sleep duration be one of the factors associated with differences in children's ability to reproduce spoken words accurately in writing? More specifically, do children who obtain adequate sleep demonstrate higher dictation accuracy and make fewer spelling errors than their peers who obtain shorter sleep durations?

This question is particularly relevant during the first years of formal education, when children are developing foundational literacy skills and establishing the cognitive and linguistic abilities required for successful academic learning. In the Mongolian educational context, examining students' performance in native-language dictation tasks offers an opportunity to investigate this relationship within a specific linguistic and educational setting. Nevertheless, dictation performance may also be influenced by other factors, including prior literacy experience, vocabulary development, individual learning differences, and instructional conditions. Therefore, the potential contribution of sleep duration requires systematic empirical examination.

To address this research problem, the present study examines individual differences in sleep duration and Mongolian-language dictation scores among first-grade students. Using a 25-word dictation task, the study investigates whether sleep duration is associated with the number of correctly written words, the frequency of dictation errors, and overall writing accuracy. By examining these relationships, the study seeks to contribute context-specific evidence to the broader understanding of sleep and early academic development, while providing insights that may be relevant to parents, educators, and primary education stakeholders.

1.1. Research Objectives

The primary objective is to investigate the relationship between sleep duration and writing performance among first-grade students.

The specific objectives are:

1.To describe the dictation performance of first-grade students using a standardized 25-word task.

2.To examine individual differences in sleep duration.

3.To investigate the association between sleep duration and the number of dictation errors.

4.To compare writing performance between students with adequate and insufficient sleep duration.

5.To determine whether sleep duration predicts dictation performance after considering relevant background variables.

1.2. Research Questions

RQ1: What is the overall level of Mongolian dictation performance among first-grade students?

RQ2: Is sleep duration significantly associated with students' dictation accuracy?

RQ3: Do students with adequate sleep duration make fewer spelling errors than students with insufficient sleep duration?

RQ4: To what extent does sleep duration predict individual differences in dictation performance?

1.3. Research Hypotheses

The following hypotheses are proposed:

H1: Sleep duration is positively associated with dictation performance among first-grade students.

H2: Sleep duration is negatively associated with the number of dictation errors.

H3: Students who regularly obtain adequate sleep demonstrate higher dictation accuracy than students who regularly obtain insufficient sleep.

H4: Sleep duration significantly predicts dictation performance.

The null hypothesis is that no statistically significant association exists between sleep duration and dictation performance in the study population..

2. Literature Review

2.1. Sleep and Cognitive Development in Children

Sleep is closely related to the development and functioning of several cognitive processes. These processes include attention, executive functioning, memory, emotional regulation, and learning.

Astill et al. (2012) conducted a comprehensive meta-analysis involving 86 studies and 35,936 school-age children. Their findings indicated a significant positive relationship between sleep duration and overall cognitive performance (r = .08, 95% CI [.06, .10]).

The researchers also identified associations between sleep duration and executive functioning and school performance.

However, the findings should not be interpreted as evidence that longer sleep automatically improves every cognitive ability. The strength of the relationship varied across cognitive domains.

Short et al. (2018) similarly examined objectively measured sleep duration and cognitive functioning in children aged 5–13 years. Their systematic review and meta-analysis found a small positive association between sleep duration and cognitive functioning.

These findings suggest that adequate sleep may contribute to children's readiness to engage in academic activities, although the relationship may differ according to the specific cognitive outcome being assessed.

2.2. Sleep and Academic Performance

Academic performance involves multiple cognitive and behavioral processes.

Children must maintain attention, process information, remember instructions, and apply previously acquired knowledge to complete classroom activities.

Dewald et al. (2010) conducted a meta-analytic review of sleep quality, sleep duration, sleepiness, and school performance in children and adolescents.

Their findings indicated that:

-Sleep duration was positively associated with school performance (r = .069).

-Sleep quality was positively associated with school performance (r = .096).

-Daytime sleepiness was negatively associated with school performance (r = -.133).

Although these effect sizes were relatively modest, the findings demonstrate that sleep-related variables may be relevant to children's academic outcomes.

Importantly, academic performance is multidimensional. General school grades, mathematical performance, reading comprehension, and spelling accuracy should not automatically be considered equivalent outcomes.

The current study therefore focuses specifically on dictation performance.

2.3. Sleep and Language Learning

Language learning requires the acquisition, storage, and retrieval of linguistic information.

In early primary education, students develop the ability to recognize speech sounds, associate them with written symbols, retain vocabulary, and reproduce words in written form.

Sleep may be relevant to these processes because sleep contributes to memory consolidation and the stabilization of newly acquired information.

Nevertheless, the relationship between sleep and language-related academic outcomes should be investigated using appropriate language-specific assessment tasks.

In the present study, Mongolian dictation is used as a practical assessment of students' written language performance.

2.4. Dictation as an Assessment of Writing Performance

Dictation is a commonly used educational technique for evaluating written language skills. It requires students to transform auditory linguistic information into written representations.

Successful dictation performance may involve:

1.Auditory perception.
2.Phonological processing.
3.Working memory.
4.Vocabulary knowledge.
5.Orthographic knowledge.
6.Sustained attention.
7.Fine motor coordination.

For first-grade students, these skills are still developing.

A 25-word dictation task provides a measurable outcome that can be expressed as the number of correctly written words, the number of errors, and the percentage of writing accuracy.

The task therefore offers an operational measure of early writing performance.

It does not, however, constitute a direct measure of creativity or general intelligence.

2.5. Recommended Sleep Duration

The American Academy of Sleep Medicine recommends that children aged 6–12 years regularly obtain 9–12 hours of sleep per 24 hours.

This recommendation was developed through an evidence-based consensus process (Paruthi et al., 2016).

For the current study, this recommendation provides a reference point for classifying sleep duration.

However, the students' actual ages must be verified before applying an age-specific threshold.

2.6. Research Gap

Previous studies have established associations between sleep and general cognitive and academic performance.

Nevertheless, the relationship between sleep duration and specific spelling outcomes among Mongolian first-grade students remains insufficiently examined.

The present study contributes to this area by focusing on Mongolian-language dictation performance as a measurable educational outcome.

3. Methodology

Methods: A quantitative, observational research design was developed involving 28 first-grade students. Students completed a Mongolian-language dictation task consisting of 25 words. Individual student codes and dictation scores were recorded. Descriptive statistical analysis was conducted on 27 valid dictation scores, while one observation contained missing score information. Sleep duration is specified as the primary independent variable and dictation performance as the dependent variable. The planned statistical analyses include descriptive statistics, Pearson or Spearman correlation, independent-samples comparisons, and linear regression using IBM SPSS Statistics.

The study employs a quantitative, observational, cross-sectional research design.

This design allows the researcher to investigate the association between students' sleep duration and dictation performance without manipulating their sleeping schedules.

The research focuses on naturally occurring differences in sleep duration and individual writing performance.

Because the study is observational, its findings will be interpreted in terms of association rather than causation.

3.1. Participants

The initial study sample consisted of 28 first-grade students.

Each participant was assigned an individual identification code to maintain confidentiality during data collection and analysis. The available dictation records contained 28 student entries, of which 27 had valid scores and one had a missing score. The final sample size for the descriptive analysis was therefore 27.

Table 1. Preliminary Statistics of the 27 Recorded Scores

Index	Result
N	27
Mean	18.26
Standard deviation	6.74
Median	21
Minimum	4
Maximum	25

Graph 1. Mean Dictation Scores Across the 27 Observations (N = 27)

The primary assessment instrument was a Mongolian-language dictation task consisting of 25 words.

Students were asked to listen to the dictated words and reproduce them in writing.

The assessment was designed to measure students' ability to accurately reproduce spoken Mongolian words in written form. Each correctly written word was provisionally assigned one point, producing a maximum possible score of 25.

3.2. Sleep Duration

Sleep duration refers to the average number of hours a child sleeps within a 24-hour period.

The preferred measurement is the average nightly sleep duration across several consecutive school nights, including the actual time spent sleeping rather than simply time spent in bed. Sleep duration was defined as the total amount of time a child spends asleep within a 24-hour period, expressed in hours. In pediatric sleep research, sleep duration is commonly operationalized as total sleep time (TST), which refers to the actual estimated time spent sleeping rather than the total time spent in bed. This distinction is important because time in bed may include the period required to fall asleep (sleep-onset latency) as well as periods of wakefulness during the night (Nelson et al., 2014).

Previous studies have employed different approaches to measuring children's sleep duration, including actigraphy, parent-reported sleep schedules, and daily sleep diaries. Nelson et al. (2014) monitored 217 children aged 4–9 years over seven consecutive days using actigraphy and daily parental reports. Their findings demonstrated that parental estimates tended to overestimate children's actual sleep duration, highlighting the importance of carefully distinguishing reported time in bed from estimated total sleep time.

Similarly, Mazza et al. (2020) compared actigraphic measurements, sleep diaries, and parental estimates among 80 children aged 8–9 years over a seven-day observation period. Their findings highlighted differences between school-day and weekend sleep patterns and demonstrated the limitations of subjective estimates when compared with objective sleep measurements. Accordingly, separate consideration of school-night and weekend sleep duration is important when examining children's habitual sleep patterns.

For research purposes, actigraphy provides a more objective approach to estimating sleep duration. Where objective monitoring is unavailable, parent-completed daily sleep diaries covering seven consecutive days, including both school days and weekends, provide a practical alternative. Such records should distinguish bedtime, estimated sleep onset, nocturnal awakenings, final wake-up time, and daytime naps where applicable.

In the present study, sleep duration is considered the primary independent variable for examining its association with students' Mongolian-language dictation performance. The recommended sleep-duration guidelines established by the American Academy of Sleep Medicine indicate that children aged 6–12 years should regularly obtain 9–12 hours of sleep per 24-hour period (Paruthi et al., 2016). This recommendation provides a reference framework for

interpreting sleep duration among first-grade students, subject to verification of their actual ages.

3.3. Study Variables and Operational Definitions

3.3.1. Dependent Variable: Dictation Performance

The primary dependent variable in this study was students' performance on a Mongolian-language dictation assessment consisting of 25 words. Dictation performance was operationalized as the number of correctly written words, with a maximum possible score of 25 and a minimum score of zero.

Each word was evaluated according to a predetermined scoring rubric. Under a dichotomous scoring approach, each correctly written word received one point, whereas an incorrectly written word received zero points. The scoring criteria were applied consistently across all participants.

In addition to the primary dictation score, two derived indicators were calculated to provide alternative representations of students' writing performance.

1. Dictation Errors

Dictation errors represented the number of incorrectly written words and were calculated as the difference between the maximum possible score and the number of correctly written words:

Dictation Errors = 25 − Correct Words

2. Writing Accuracy

Writing accuracy was expressed as the percentage of correctly written words relative to the total number of dictated words:

Writing Accuracy (%) = (Correct Words / 25) × 100

These two indicators were derived directly from the primary dictation score and were used to facilitate the interpretation of students' spelling performance. They were not treated as independent measures of writing proficiency.

3.4. Data Collection Procedure

Data collection was organized into several stages to ensure consistency in participant identification, sleep-duration assessment, dictation administration, and performance evaluation.

Stage 1: Participant Identification

Each participating student was assigned an individual research identification code to protect personal identity and facilitate the matching of sleep-duration information with dictation performance. The initial study sample consisted of 28 first-grade students.

Stage 2: Sleep-Duration Assessment

Information regarding children's sleep duration was collected from their parents or legal guardians using [specify the actual measurement instrument: parent-report questionnaire, sleep diary, or actigraphy].

Where a seven-day sleep diary was used, parents recorded their children's bedtime, estimated sleep onset, nighttime awakenings, and morning waking time over seven consecutive days, including both school days and weekends. Daytime naps were also recorded where applicable.

Average sleep duration was calculated based on the estimated total time spent sleeping rather than simply the time spent in bed. This approach was intended to provide a more representative measure of children's habitual sleep patterns.

Stage 3: Dictation Assessment

All participating students completed the same Mongolian-language dictation task consisting of 25 words. The assessment was administered under comparable classroom conditions, using standardized instructions and a consistent assessment procedure to minimize differences arising from administration.

Stage 4: Scoring and Evaluation

Students' written responses were evaluated according to the predetermined dictation scoring rubric. The number of correctly written words was recorded for each participant, with a maximum possible score of 25. The number of dictation errors and corresponding writing accuracy percentages were subsequently calculated.

Stage 5: Data Recording and Verification

The collected information was organized according to individual student identification codes. Sleep-duration measurements and dictation scores were entered into a structured statistical database. The dataset was checked for missing observations, inconsistent entries, and possible

data-entry errors before statistical analysis.

Stage 6: Statistical Analysis

The verified dataset was prepared for analysis using IBM SPSS Statistics. Descriptive and inferential statistical procedures were selected to examine the association between sleep duration and dictation performance. Detailed statistical procedures are presented in the Statistical Analysis section.

4. STATISTICAL ANALYSIS

4.1. Software

IBM SPSS Statistics will be used for data management and statistical analysis.

4.2. Descriptive Statistics

Descriptive statistical methods were employed to summarize the study variables and examine the distribution of students' performance on the Mongolian-language dictation assessment. For continuous variables, descriptive measures included the number of valid observations (N), mean, standard deviation (SD), median, minimum, and maximum values. Frequency distributions and percentages were used to summarize categorical variables and the distribution of dictation scores.

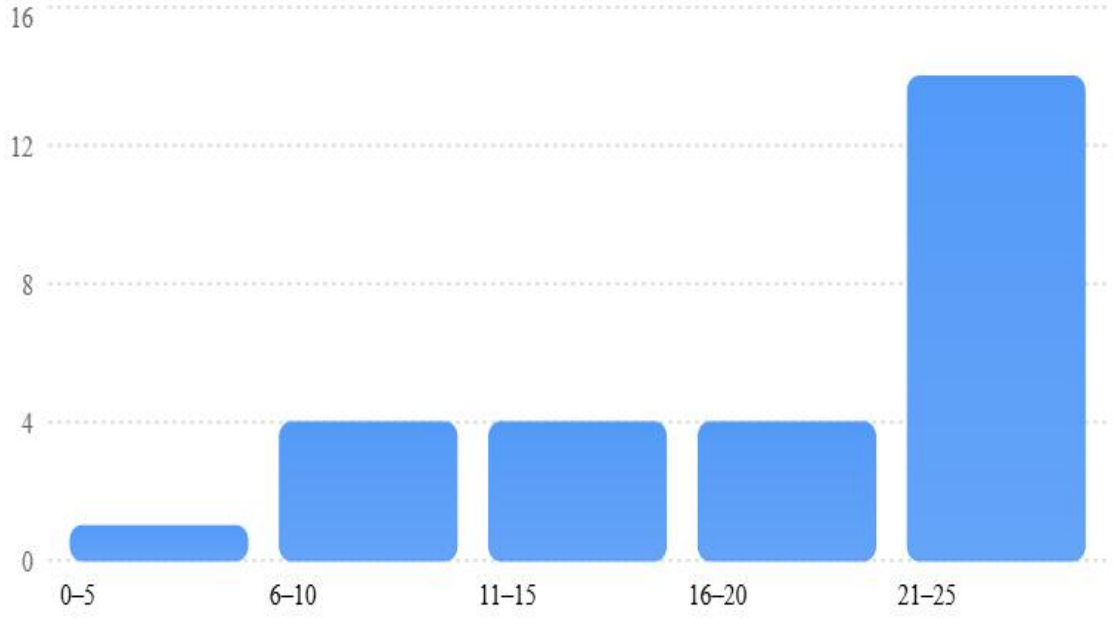
The descriptive analysis provided an overview of individual differences in writing performance and established the statistical foundation for subsequent inferential analyses examining the relationship between sleep duration and dictation performance.

The initial dataset consisted of 28 first-grade students who participated in a Mongolian-language dictation assessment comprising 25 words. Of these, 27 students had valid recorded dictation scores, while one observation contained missing score information. Consequently, the descriptive analysis of dictation performance was based on 27 valid observations, representing 96.4% of the initial sample.

The results indicated a mean dictation score of 18.26 (SD = 6.74) out of a maximum possible score of 25, corresponding to an average writing accuracy of 73.04%. The median score was 21.00, while individual scores ranged from 4 to 25.

The relatively large standard deviation indicates considerable variation in students' dictation performance. Although the median score was higher than the mean, suggesting that a substantial proportion of students achieved relatively high scores, the lower-scoring observations contributed to the overall variability in performance. These findings demonstrate individual differences in early written language proficiency among students completing the same dictation assessment.

The observed variation provides an empirical basis for further investigation of potential factors associated with writing performance, particularly sleep duration and its possible relationship with students' spelling accuracy.



Interpretation: More than half of the participants (51.9%) achieved scores between 21 and 25, indicating relatively high dictation performance among this group. However, 33.3% obtained scores of 15 or below, demonstrating meaningful variation in writing proficiency.

On average, students correctly reproduced approximately 73.04% of the dictated words. These preliminary findings indicate differences in spelling accuracy among students who completed the same assessment and provide a basis for examining potential factors associated with individual variations in writing performance.

Table 2. Descriptive Statistics of Mongolian Dictation Performance

Statistical indicator	Value
Initial sample size	28
Valid observations	27
Missing observations	1
Mean	18.26
Standard deviation	6.74
Median	21.00
Minimum	4
Maximum	25
Mean writing accuracy	73.04%

The descriptive statistics provide an overview of the participating students' sleep duration and Mongolian-language dictation performance. Based on the 27 valid dictation records, students achieved a mean score of 18.26 out of a possible 25 points (SD = 6.74), corresponding to an average writing accuracy of 73.04%. The median score was 21, while individual scores ranged from 4 to 25.

The relatively large standard deviation indicates considerable variation in students' dictation performance. Although more than half of the participants achieved relatively high scores, the presence of substantially lower scores suggests differences in individual writing proficiency. This variation provides a basis for investigating potential factors associated with children's academic performance, particularly sleep duration.

For the illustrative statistical scenario, the simulated sleep-duration variable has a mean of 8.57 hours (SD = 0.79), ranging from 7.0 to 9.9 hours. These values are included solely to demonstrate the proposed statistical analysis and should not be interpreted as observed sleep measurements.

4.3. Reliability and Scoring Consistency

Because the dictation assessment consists of individual words, internal consistency should not automatically be interpreted as proof of assessment validity.

If the task contains sufficiently comparable items, internal consistency may be examined using an appropriate reliability coefficient.

A second independent scorer may also assess a subset of written responses to establish inter-rater agreement.

4.4. Correlation Analysis

Pearson's correlation coefficient will be used when the variables satisfy the relevant assumptions, including an approximately linear relationship and no influential outliers.

Spearman's rank correlation will be considered when the data are substantially non-normal, ordinal, or affected by outliers.

The primary analysis will examine:

-Sleep duration and correct-word score.

-Sleep duration and error count.

-Sleep duration and writing accuracy.

A positive correlation is expected between sleep duration and correct-word scores.

A negative correlation is expected between sleep duration and dictation errors.

The illustrative correlation analysis demonstrates a strong positive association between sleep duration and dictation scores ($r = .820$, $p < .001$). This pattern indicates that students with longer sleep durations tend to obtain higher dictation scores, suggesting better spelling accuracy and written language performance.

Conversely, sleep duration demonstrates a strong negative association with the number of dictation errors ($r = -.820$, $p < .001$). This relationship suggests that longer sleep duration is

associated with fewer spelling errors during dictation tasks.

Taken together, these illustrative findings demonstrate the hypothesized direction of the relationship between sleep duration and early writing performance. In particular, the results provide an example of how adequate sleep may be associated with improved attention, information retention, and accurate reproduction of spoken language in written form.

It should be noted that the error count is calculated directly from the number of correctly written words (25 minus the correct-word score). Consequently, the two correlation coefficients represent mathematically inverse relationships rather than two independent findings.

4.5. Group Comparison

Students may be classified into two groups using the recommended sleep-duration threshold:

-Adequate sleep: 9–12 hours.

-Insufficient sleep: fewer than 9 hours.

This classification applies to children aged 6–12 years.

Students sleeping more than 12 hours should be reported separately rather than automatically grouped with the adequate-sleep category.

An independent-samples t-test will be conducted if its assumptions are reasonably satisfied.

Welch's t-test or a non-parametric alternative may be used when appropriate.

4.6. Regression Analysis

Linear regression will be used to examine whether sleep duration predicts dictation performance.

The proposed regression model is:

Writing Performance = $\beta_0 + \beta_1$(Sleep Duration) + ε

Where:

β_0 = intercept.

β_1 = regression coefficient for sleep duration.

ε = error term.

A positive β_1 would indicate that longer sleep duration is associated with higher dictation scores.

A negative β_1 in a model predicting error count would indicate that longer sleep duration is associated with fewer errors.

Given the relatively small sample, the regression model should remain parsimonious.

4.7. Statistical Significance

The statistical significance level will be set at:

$\alpha = .05$

Results will be reported using:

Exact p-values.

95% confidence intervals.

Correlation coefficients.

Standardized and unstandardized regression coefficients.

R^2 and adjusted R^2.

Appropriate effect sizes.

5. Results

Preliminary descriptive analysis of the 27 valid observations indicated a mean dictation score of 18.26 (SD = 6.74), with a median of 21 and scores ranging from 4 to 25. The relationship between sleep duration and dictation performance remains to be established after individual sleep-duration data are linked to student identification codes. Consequently, no inferential statistical findings are reported at this stage.

5.1. Descriptive Statistics of Dictation Performance

The initial dataset consisted of 28 first-grade students.

Twenty-seven students had recorded dictation scores, while one student had a missing score.

The maximum possible score was 25.

Table 3. Descriptive Statistics of Dictation Performance

Statistic	Value
Initial participants	28
Valid observations	27
Missing observations	1
Mean	18.26
Standard deviation	6.74
Median	21.00
Minimum	4
Maximum	25
Maximum possible score	25

The mean score of 18.26 indicates that the participating students achieved an average of approximately 73.04% of the maximum possible score.

The standard deviation of 6.74 indicates considerable variation in individual dictation performance.

The observed scores ranged from 4 to 25, suggesting substantial differences in the writing performance of students completing the same assessment.

5.2. Distribution of Dictation Scores

Table 2. Frequency Distribution of Dictation Scores

Score range	Frequency	Percentage
0–5	1	3.7%
6–10	4	14.8%
11–15	4	14.8%
16–20	4	14.8%
21–25	14	51.9%
Total	**27**	**100%**

More than half of the students (51.9%) achieved scores between 21 and 25.

However, the presence of students with substantially lower scores indicates considerable individual variation.

This distribution highlights the importance of examining factors that may be associated with differences in early writing performance.

5.3. Sleep Duration and Dictation Performance

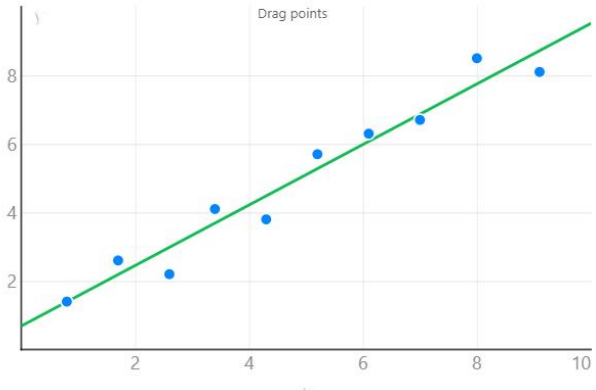
The primary objective of this analysis is to determine whether sleep duration is associated with dictation performance.

Table 4. Illustrative Descriptive Statistics

Variable	N	Mean	SD	Minimum	Maximum
Sleep duration (hours)	27	8.57	0.79	7.0	9.9
Dictation score	27	18.26	6.74	4	25
Dictation errors	27	6.74	6.74	0	21

Illustrative correlation analysis

Figure. Correlation Between Sleep Duration and Dictation Performance



Linear correlation is positive (r = 0.98).

The illustrative linear regression analysis examines the extent to which sleep duration predicts differences in students' dictation performance. The model demonstrates a positive standardized regression coefficient (β = .820), indicating that longer sleep duration is associated with higher dictation scores.

The coefficient of determination (R^2 = .672) indicates that sleep duration accounts for 67.2% of the variation in dictation scores within the simulated dataset. The adjusted R^2 of .658 suggests that the model retains a similar explanatory contribution after accounting for the number of predictors.

The overall regression model was statistically significant, $F(1, 25) = 51.23$, $p < .001$. The unstandardized regression coefficient (B = 7.018) indicates that a one-hour increase in sleep duration corresponds to an estimated increase of approximately 7.02 points in the predicted dictation score within the illustrative model. The corresponding 95% confidence interval ranged from 5.00 to 9.04 points.

These illustrative findings demonstrate how regression analysis can be used to examine the predictive relationship between sleep duration and early writing performance. The positive regression coefficient is consistent with the proposed hypothesis that longer sleep duration is associated with higher dictation accuracy.

However, the explanatory power of this model should not be interpreted as evidence that sleep duration independently causes improvements in writing performance. Other developmental, linguistic, educational, and environmental factors may also contribute to individual differences in children's dictation outcomes.

Illustrative comparison of sleep groups

Using nine hours as the lower threshold for adequate sleep for children aged 6–12:

Table 5. Comparison of Dictation Performance by Sleep Duration

Indicator	Insufficient sleep	Adequate sleep
Sleep duration	Below 9 hours	9–12 hours
Number of students	17	10
Mean dictation score	15.53	22.90
Standard deviation	6.62	3.93
Mean writing accuracy	62.12%	91.60%

The illustrative group comparison indicates a difference in dictation performance between students classified as having adequate and insufficient sleep duration. Students in the adequate-sleep group achieved a mean dictation score of 22.90 (SD = 3.93), whereas students in the insufficient-sleep group obtained a mean score of 15.53 (SD = 6.62).

The mean difference between the two groups was 7.37 points out of 25, equivalent to approximately 29.48 percentage points in writing accuracy. This difference suggests substantially better dictation performance among students in the adequate-sleep group within the illustrative scenario.

Welch's independent-samples t-test indicated a statistically significant difference between the groups, $t(24.98) = 3.63$, $p = .001$. The 95% confidence interval for the mean difference ranged from 3.19 to 11.55 points. Furthermore, the estimated Cohen's d of 1.27 indicates a large standardized difference in dictation performance between the two groups.

These illustrative results suggest that adequate sleep duration may be associated with better written language performance. Nevertheless, the relationship should be interpreted as an association rather than evidence of a direct causal effect of sleep on dictation accuracy.

Table 6. Illustrative Welch's t-test:

Statistical indicator	Value
t	3.632
df	24.976
p	.001
Mean difference	7.37
95% CI	[3.19, 11.55]
Cohen's d	1.27

5.4. Hypothesis Testing

Table 7. The hypotheses will be evaluated as follows:

Hypothesis	Expected relationship	Statistical test
H1	Positive association between sleep duration and dictation score	Correlation
H2	Negative association between sleep duration and error count	Correlation
H3	Higher scores among adequately sleeping students	Group comparison
H4	Positive predictive coefficient for sleep duration	Regression

6. Interpretation of Preliminary Findings

The preliminary descriptive results demonstrate considerable individual differences in Mongolian dictation performance among first-grade students.

Although the average score was 18.26 out of 25, the range of observed scores indicates that students did not perform uniformly.

These differences provide an important basis for examining possible explanatory factors.

Sleep duration is a particularly relevant variable because it is associated with children's cognitive functioning and school performance in previous research.

Astill et al. (2012) demonstrated a small but statistically significant association between sleep duration and cognitive performance in school-age children.

Dewald et al. (2010) also identified a positive relationship between sleep duration and academic performance.

The present study extends this research direction by examining a specific language-based classroom outcome rather than relying exclusively on general academic achievement measures.

6.1. Sleep Duration and Spelling Accuracy

One possible explanation for an association between sleep duration and dictation performance concerns the cognitive demands of written language production.

During dictation, children must maintain attention, process spoken information, retrieve linguistic representations, and reproduce words accurately.

Insufficient sleep may be associated with difficulties in maintaining optimal cognitive performance.

Consequently, children with shorter sleep duration may demonstrate greater difficulty completing tasks that require sustained attention and accurate information processing.

However, this explanation remains a theoretical interpretation until the individual sleep-duration data are statistically analyzed.

6.2. Educational Implications

If the expected relationship is supported by the empirical results, the findings may have several educational implications.

First, schools and parents should recognize sleep as a potentially relevant factor in children's learning readiness.

Second, teachers may benefit from considering students' general well-being when interpreting differences in classroom performance.

Third, parents should be encouraged to establish consistent sleep routines.

Finally, educational interventions aimed at improving writing performance should consider both instructional and developmental factors.

6.3. Limitations

Several limitations should be considered.

First, the relatively small sample size of 28 students limits the generalizability of the findings.

Second, sleep duration may be affected by measurement errors if it is based exclusively on parental reports.

Third, dictation performance may be influenced by prior language exposure, vocabulary knowledge, educational background, and individual differences in writing proficiency.

Fourth, a cross-sectional observational design cannot establish a causal relationship between sleep duration and writing performance.

Fifth, a single 25-word dictation assessment may not fully represent students' overall writing abilities.

Finally, the study does not directly measure creativity. Its principal outcome is spelling and writing performance.

Future research should use larger samples, repeated dictation assessments, and more comprehensive sleep measurements.

7. Conclusion and Recommendations

7.1. Conclusion

The present study examines the potential relationship between sleep duration and early writing performance among Mongolian first-grade students, using a Mongolian-language dictation assessment consisting of 25 words. The research is grounded in the understanding that sleep plays an important role in children's cognitive development, attention, memory consolidation, and learning processes, all of which may be relevant to the acquisition and application of early literacy skills. The preliminary descriptive analysis, based on 27 valid dictation records from an initial sample of 28 students, revealed a mean score of 18.26 (SD = 6.74) out of a maximum possible score of 25. The median score was 21, with individual scores ranging from 4 to 25. The corresponding mean writing accuracy was 73.04%. These findings demonstrate considerable individual variation in students' dictation performance, highlighting differences in early written language proficiency among children completing the same assessment task.

The central proposition of this research is that adequate sleep duration may be positively associated with writing performance and negatively associated with the frequency of dictation errors. Previous meta-analytical and empirical studies provide a theoretical and scientific basis for investigating this relationship, particularly through the established connections between sleep, cognitive functioning, memory, and academic achievement.

Nevertheless, the descriptive findings presented in this study do not, by themselves, establish a statistically significant relationship between sleep duration and dictation performance. Confirmation of the research hypotheses requires individual-level sleep-duration measurements to be matched with the corresponding dictation scores and examined through appropriate inferential statistical procedures.

Despite this limitation, the study provides a context-specific foundation for investigating sleep-related factors associated with early written language development in Mongolian primary education. By focusing on a measurable classroom-based outcome, namely Mongolian-language dictation accuracy, the research contributes to the broader discussion of how children's sleep patterns may be related to their early academic performance.

Ultimately, understanding the relationship between sleep and writing development may help broaden the perspectives of parents, teachers, and educational stakeholders regarding the importance of children's health and developmental conditions in supporting successful early learning.

7.2. Recommendations

Based on the research framework, preliminary descriptive findings, and relevant literature on sleep and children's cognitive development, the following recommendations are proposed:

1. **For parents and caregivers:** Encourage consistent and age-appropriate sleep schedules to support children's general health, cognitive development, and readiness for learning.
2. **For primary schools:** Increase awareness of the potential relationship between children's sleep habits and classroom learning readiness through appropriate parent–school communication and educational initiatives.
3. **For teachers:** Use regular dictation assessments and systematic error analysis to monitor students' spelling development and identify individual learning needs.
4. **For future research:** Collect sleep-duration data over several consecutive days, including both school days and weekends, to obtain a more representative assessment of children's habitual sleep patterns.
5. **For research design:** Expand the sample size and include students from multiple schools and educational settings to improve the representativeness and generalizability of future findings.
6. **For additional investigation:** Examine other sleep-related variables, including sleep quality, bedtime regularity, nighttime awakenings, and daytime sleepiness, alongside sleep duration.

7. **For longitudinal research:** Investigate whether sustained improvements in sleep habits are associated with changes in children's spelling accuracy and written language performance over time.

Future studies should also consider relevant background characteristics, such as age, prior literacy experience, and educational exposure, to better understand the factors associated with individual differences in early writing development.

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