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Development of Statistics Teaching Materials: Analysis of The Effect of High Intensity Textual Seductive Detail on The Understanding of Statistics Learning in Psychology Students

Carla Marsha*, Desvi Yanti Mukhtar, Sri Supriyantini
Faculty of Psychology, Universitas Sumatera Utara, Medan, 20155, Indonesia

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* *Corresponding author:*

E-mail: carlamarrsha@gmail.com

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A B S T R A C T

Statistics courses for psychology students are often considered difficult, requiring teaching materials that enhance engagement without hindering conceptual understanding. One approach is adding textual seductive details—unique but irrelevant narratives or facts—to learning content. This study aimed to develop statistical teaching materials and examine the effect of high-intensity textual seductive details on students' understanding. Using a one-group pretest–posttest design with 15 psychology students, statistical understanding was measured before and after the intervention and analyzed using the Wilcoxon Signed-Rank Test. Results showed a significant improvement between pretest and posttest scores ($Z = -3.041$, $p = .002$, $r = .79$), indicating a strong positive effect of high-intensity seductive details on learning. Spearman's correlation revealed no significant relationship between prior knowledge, cognitive load, and posttest results. However, a moderate negative correlation appeared between cognitive load and posttest performance ($\rho = -.438$; $p = .102$), suggesting that higher cognitive load tends to reduce understanding, though not significantly. Therefore, integrating high-intensity seductive details should be balanced with careful management of cognitive load in designing statistical learning materials.

1. Introduction

Statistics is a fundamental course for psychology students because it provides the basis for understanding research methodology, interpreting empirical findings, and making data-driven decisions (Hun Lim et al., 2015)(Allen et al., 2016). The Statistics course covers data collection, data management, data analysis, data interpretation, presenting the results of analysis and interpretation, and drawing conclusions and making decisions based on these activities. However, in classroom learning practices, statistics is often perceived as a difficult course, making it

difficult for students to build conceptual understanding, particularly when connecting analysis procedures to the meaning of the results and their interpretation (Clark et al., 2025)(Prayoga & Abraham, 2017)(Roberts, 2016)(Andriani, 2025).

These difficulties are not only related to the cognitive demands of the material but also to learning engagement. When students find material uninteresting or difficult to access, their attention and learning persistence can potentially decline, ultimately hindering understanding. Therefore, learning designs and teaching materials are needed that not only present concepts systematically but also stimulate situational interest to keep students engaged in challenging material. One instructional design approach to increase interest is the insertion of seductive details. Seductive details are additional information that is interesting but not directly necessary to achieve the main instructional goal (Bender et al., 2021)(Rey, 2012)(Kienitz et al., 2023)In the context of text-based teaching materials, this form can take the form of a short narrative, a “tickling” example, or an interesting fact inserted to make the reading more lively and attract the learner’s attention.

This approach is relevant to the concept of situational interest, namely, interest that arises from the conditions or characteristics of the learning situation/material (e.g., novelty or intensity), thereby capturing attention and encouraging involvement in learning tasks (Park, 2016)(Kleespies et al., 2024)(Yoo, 2016)(Mägdefrau et al., 2025)(Febriyanti & Andriani, 2025). Situational interest is understood as interest triggered by a specific environment or object. In the initial phase, it can appear as a short-term interest supported by external factors within the material. Thus, the inclusion of seductive details can aid statistical learning by enabling students to become more immersed in the material from the outset (Palmer, 2019)(Yoo, 2016).

Learning outcomes, or knowledge outcomes, are changes that occur in students as a result of systematic learning experiences. These changes include aspects of knowledge that can be observed and measured objectively (Siddik et al., 2025)(Bloom, 1956)(Saily, 2019). In the context of statistics learning, knowledge outcomes are crucial because low achievement in this aspect impacts not only short-term academic performance but also the sustainability of students' academic processes. Low knowledge outcomes correlate with difficulties in understanding the implementation of statistics in research methods (Dadzie et al., 2024)(McLinton & Wells, 2023)(Huang & Huang, 2025)(Sausan et al., 2025), difficulty interpreting research results (Kumia et al., 2024). Previous research has consistently found that students with limited statistical knowledge tend to experience difficulties with final assignments, such as theses and dissertations (Dani & Al Quraan, 2023).

However, inserting non-essential, interesting information also risks reducing learning quality. Harp and Mayer explain that seductive details can harm learning through three pathways: distracting the selection of relevant information (distraction), disrupting the formation of coherence or mental models (disruption), and diverting processing by activating prior knowledge inappropriate for the core material (diversion). In statistics learning, which demands gradual processing and conceptual precision, this risk is important to consider because divided attention

can increase processing load and make core information less deeply processed (Harp & Mayer, 1998).

Variations in previous research findings suggest that the effect of seductive details may depend on how they are designed and inserted into the material. Therefore, more specific exploration is needed in the context of statistics teaching materials, particularly when details are inserted into the text and presented with high intensity (high-intensity textual seductive details). On the one hand, high intensity is expected to spark interest and maintain engagement; on the other hand, it can increase cognitive load and thus interfere with comprehension if not carefully managed.

Based on these considerations, this study focuses on developing statistical teaching materials that integrate high-intensity textual seductive detail and testing the effect of their use on student comprehension. Testing was conducted by comparing comprehension before and after using the teaching materials within the same group (one-group pretest–posttest design), allowing changes in comprehension to be observed through differences in pretest and posttest scores. Pretest–posttest designs within-subjects are commonly analyzed using the nonparametric Wilcoxon signed-rank test when the data are paired and do not assume normality. In addition, this study explores the relationships among prior knowledge, cognitive load, and posttest achievement to determine whether these factors are associated with learning outcomes after the teaching materials intervention.

2. Methodology

Research Design

This study employed a quantitative, quasi-experimental design with a one-group pretest–posttest. In this design, the same participants were given a pretest to measure statistical understanding before treatment, then underwent learning using teaching materials developed with high-intensity, seductive textual detail, and then were given a posttest to measure understanding after treatment.

Participants and Sampling Techniques

The study participants were 15 psychology students [institution name: adjust], recruited using a purposive sampling technique based on the following inclusion criteria: (1) active students, (2) willing to participate in the entire research series, and (3) having passed the statistics course. Participants who did not complete the entire series of procedures or had conditions that could potentially interfere with engagement in learning [e.g., certain visual impairments where relevant] were excluded from the analysis in accordance with the study's provisions. This study focused on one main treatment, namely the use of statistics teaching materials containing high-intensity textual seductive detail (independent variable/treatment). The dependent variable was statistical understanding, which was measured through knowledge test scores (pretest and posttest) on the material taught in the teaching

materials. The learning materials focus on the nonparametric statistics topics taught in the teaching materials, namely the Mann–Whitney U Test (definition, purpose of use, conditions of use, procedure/ranking, interpretation of U and p-values, and comparison with the independent t-test). The materials are presented in an interactive course format based on the Canva course, with a consistent structure of learning objectives and case examples throughout the teaching materials.

Research instruments

The research instruments used in this study consisted of high-intensity textual seductive detail, statistical comprehension tests (pretest and posttest), and cognitive load measurements, used as additional analyses.

High intensity textual seductive detail

High-intensity, detailed, seductive textual stimuli were developed iteratively using the Successive Approximation Model framework to ensure appropriate manipulation of textual characteristics without altering the complexity of the core material. The rationale for development was based on Cognitive Load Theory, which states that interesting but irrelevant information can increase extraneous cognitive load through competition in verbal processing channels (Sweller, 2020), as well as on the finding that increasing text length and vividness amplifies salience and potential distraction (Harp & Mayer, 1998).

Learning materials on the Mann–Whitney U test are presented in an interactive digital module. Core content includes definitions, functions, usage conditions, procedural terms (ranks, U, p-value, null hypothesis), and comparisons with independent t-tests. A detailed, seductive narrative is structured at 13–35 words per page and placed before the core material. The language includes personal framing, emotional diction, and light sensory descriptions that are not conceptually related to statistical procedures and do not contain analogies or clues to answers.

Content validation was conducted through expert judgment by three experts with total scores of 83, 73, and 69, respectively (M = 75). Based on the validity criteria (70.01–85 = quite valid), the stimulus was declared feasible with minor revisions. The language appeal aspect received scores of 5, 4, and 4, while the intensity consistency received scores of 4, 4, and 4, indicating expert agreement on verbal salience and clarity of manipulation. Formative evaluation through concurrent think-aloud with four students showed consistent perceptions that the text felt “dense” and “cognitively taxing,” indicating increased verbal processing demands as expected theoretically.

Fidelity Manipulation

Manipulation fidelity was maintained through three mechanisms: (1) equivalence of core content across all learning pages, (2) limiting manipulation to the length, position, and verbal salience of supplementary narratives, and (3) expert verification of potential cognitive distractions. Technical revisions were made to

navigation and instructional aspects without changing textual characteristics. Thus, the changes were isolated to the intensity of textual seductive detail, not to the conceptual structure of the learning material.

Statistical comprehension test

The statistical comprehension test is structured as multiple-choice questions that refer to the learning objectives of the Mann–Whitney U Test material presented in the teaching materials. The test is given twice to the same participants, namely before the learning intervention (pretest) to capture initial abilities and after the learning intervention (posttest) to assess understanding after using teaching materials with high-intensity textual seductive detail. The test score is calculated by assigning 1 to correct answers and 0 to incorrect answers, and then summing them to form a total statistical comprehension score. The test instrument is structured around a grid (blueprint) that maps understanding indicators to the targeted competencies, so that the test items represent the aspects of understanding to be measured.

Cognitive load measurement

In addition to the comprehension test, this study can also use a cognitive load scale as a subjective measure of participants' perceived mental effort while studying the material. This measurement aims to capture the extent to which participants perceive processing load when interacting with the learning material, especially given the potential for seductive details to increase irrelevant cognitive load. The cognitive load scale is administered after participants complete the learning (or after specific learning segments/objectives as designed), and participants are asked to rate their level of load/effort on a scale range established in the study. Higher scores indicate greater perceived cognitive load. The results of this measurement can then be used as supporting information to explain variations in posttest achievement or as additional correlational analyses, depending on the research objectives.

Data analysis techniques

Data analysis used descriptive statistics (minimum, maximum, mean, and standard deviation) to describe pretest and posttest scores. To test differences in statistical understanding before and after treatment in the same subjects, the Wilcoxon Signed-Rank Test (two-tailed) was used with a significance level of 0.05.

3. Results and Discussion

Results

This section presents the research results, including a description of participant characteristics, descriptive statistics for the research variables, and results of inferential analyses examining changes in statistical understanding before and after using the developed teaching materials. Presentation of subject characteristics is

necessary to provide a profile of the research sample, enabling readers to assess the context and limitations of the generalizability of the findings. Details of the participants' demographic characteristics and attributes (gender, age group, and distribution of IQ grades based on the SPM scale) are presented in Table 1.

Table 1. Subject Characteristics

Aspect	Category	Amount	Percentage
Gender	Woman	11	73%
	Man	4	27%
Age Group	18 - 20 Years	7	46.67%
	21 - 23 Years	6	40.00%
	24 - 25 Years	2	13.33%
IQ Grade (SPM Scale)	Grade II	4	26.67%
	Grade II +	1	6.67%
	Grade III -	4	26.67%
	Grade III	1	6.67%
	Grade III +	3	20.00%
	Grade IV -	1	6.67%
	Grade IV	1	6.67%
Total		15	100%

Based on Table 1, the research subjects were 15 students. The majority of participants were female (11 people) (73%), while 4 were male (27%). Based on age group, the majority of respondents were in the 18–20 years age range (7 people) (46.67%), followed by the 21–23 years age group (6 people) (40.00%), and the 24–25 years age group (2 people) (13.33%). Meanwhile, the distribution of IQ Grades based on the SPM Scale shows that the Grade II and Grade III categories each numbered 4 people (26.67%), Grade III+ numbered 3 people (20.00%), while Grade II+, Grade III, Grade IV-, and Grade IV each numbered 1 person (6.67%). In general, these data indicate that respondents were predominantly female, in the early adulthood age range (18–23 years), and had a relatively varied distribution of IQ levels, with the largest concentration in Grades II and III.

Table 2. Descriptive statistics

	N	Minimum	Maximum	Mean	Standard Deviation
Pretest	15	15	33	23.73	5,574
Post-test	15	20	57	35.93	9,801

Based on Table 2, the descriptive statistics for 15 respondents indicated that the pretest scores ranged from 15 to 33, with a mean (M = 23.73) and standard deviation (SD = 5.57). The relatively small standard deviation compared to the score range indicates that the distribution of pretest data is moderate, with respondents' scores relatively concentrated around the mean. Meanwhile, the post-test scores ranged from 20 to 57, with a mean (M = 35.93) and standard deviation (SD = 9.80). The higher post-test mean compared to the pretest indicates an increase in score achievement after the treatment. However, the larger post-test standard deviation indicates greater score variation, so the increase did not occur evenly across all respondents. Overall, these data indicate a tendency toward greater learning

outcomes from before to after treatment, accompanied by greater heterogeneity in performance at the post-test stage.

Table 3. Results of the Wilcoxon Signed-Rank test (textual)

Comparison	Z	p (2-tailed)
PostTH - PreTH	-3.041b	0.002

Based on Tabel 3 Hypothesis 3 states that the intensity of textual seductive detail will influence statistical comprehension. To test this hypothesis, a Wilcoxon Signed-Rank test was conducted to determine the effect of textual seductive detail intensity on statistical comprehension. The Wilcoxon test results showed that 12 participants increased their scores (positive ranks) and 3 decreased (negative ranks), with no significant difference between pretest and post-test scores. The Wilcoxon test results showed a statistically significant difference between the pretest and post-test scores, with a Z value of −3.04 and p = .002 (two-tailed). These results indicate that treatment in the TH group also significantly improved participants' post-test scores.

Table 4. Correlation Matrix Between Research Variables

			PreTH	PostTH	XTH	CL.TH	GradeIQ.TH
Spearman's rho	PreTH	Correlation Coefficient	1,000	.002	-.626*	.061	.187
		Sig. (2-tailed)	.	.995	.013	.830	.504
		N	15	15	15	15	15
	PostTH	Correlation Coefficient	.002	1,000	.671**	-.438	-.010
		Sig. (2-tailed)	.995	.	.006	.102	.972
		N	15	15	15	15	15
	XTH	Correlation Coefficient	-.626*	.671**	1,000	-.507	-.302
		Sig. (2-tailed)	.013	.006	.	.054	.274
		N	15	15	15	15	15
	CL.TH	Correlation Coefficient	.061	-.438	-.507	1,000	.079
		Sig. (2-tailed)	.830	.102	.054	.	.779
		N	15	15	15	15	15
	GradeIQ.TH	Correlation Coefficient	.187	-.010	-.302	.079	1,000
		Sig. (2-tailed)	.504	.972	.274	.779	.
		N	15	15	15	15	15

Based on Tabel 4 Spearman's rho correlation analysis of 15 respondents, several significant relationships were found at the α = .05 (2-tailed) level. The XTH variable, which is the difference in scores between the pretest and post-test (gain score after learning with high-intensity textual, seductive detail), showed a significant negative correlation with the pretest, $r_s = -.63$, p = .013, which indicates that the higher the participant's initial ability, the smaller the increase in score after learning. In contrast, XTH was positively and significantly correlated with the post-

test, $r_s = .67$, $p = .006$, indicating that the greater the gain score, the higher the final score achieved by participants. The relationship between XTH and cognitive load (CL.TH) shows a negative correlation that is close to significant, $r_s = -.51$, $p = .054$, indicating a trend that higher score increases are associated with lower cognitive load. However, this relationship has not reached statistical significance. Meanwhile, no significant relationship was found between the pretest and post-test ($r_s = .00$, $p = .995$), between post-test and cognitive load ($r_s = -.44$, $p = .102$), as well as between all variables and IQ Grade (all $p > .05$). Overall, these findings indicate that the difference in scores after high intensity textual seductive detail-based learning is the variable most consistently related to final achievement, and tends to be greater in participants with lower initial abilities. At the same time, IQ classification does not make a significant contribution to the results in this study.

Discussion

This study aims to develop statistical teaching materials that integrate high-intensity textual seductive details and test their effect on psychology students' statistical understanding. The results of the Wilcoxon Signed-Rank test showed a significant increase in understanding between pretest and post-test scores ($Z = -3.041$; $p = .002$; two-tailed) with an effect size of $r = .79$. Descriptively, the average score increased from M = 23.73 (SD = 5.57; min–max = 15–33) in the pretest to M = 35.93 (SD = 9.80; min–max = 20–57) in the post-test, so that practically the intervention was followed by improved performance even though the variation in scores in the post-test became larger.

Conceptually, these results can be understood through a motivational-cognitive pathway: engaging textual elements can trigger situational interest, thereby motivating learners to pay attention, persist in reading, and complete learning segments. The literature on learning interest explains that situational interest is triggered by the characteristics of the learning stimulus or environment and can increase engagement in the early stages of learning. In the context of statistics, which is often perceived as difficult and "less engaging," seductive textual details can serve as an initial trigger to keep students engaged with the material, increasing the opportunity for deeper processing of core information (Ye et al., 2022)(Mynard & McLoughlin, 2020)(Asher & Harackiewicz, 2024)(Syahrir et al., 2025).

This finding is important because the seductive details literature has emphasized the risk of decreased learning when interesting but irrelevant material distracts from the core idea (Kienitz et al., 2023). (Harp & Mayer, 1998) explains that seductive details can be detrimental through three main mechanisms: (1) distraction (shifting attention selection away from relevant information), (2) disruption (disrupting the formation of coherence/mental models), and (3) diversion (activating inappropriate prior knowledge for understanding core material). However, recent empirical studies also show that the effects of seductive details are not always uniform; under certain conditions, interesting details can increase engagement or interest, but still have the potential to reduce understanding if they are processed as core information or add unnecessary cognitive load. Thus, the positive results in this study can be interpreted as indicating that the developed teaching material design can leverage

interest (e.g., increasing reading engagement) without destructively "taking over" the main concept-processing structure in most participants.

(Tislar & Steelman, 2021) also concluded that there was a seductive detail effect that generally hurt learning performance (with small-to-medium effects on retention and medium effects on transfer), while emphasizing the existence of moderating factors (e.g., material characteristics, detail type, cognitive load conditions, and presentation design). This means that positive findings in this study can occur if the inserted textual details do not "shift" the focus from the core content, or if these details actually serve as attention binders that keep students engaged with the essential material. In other words, the results of this study can serve as evidence that high-intensity textual seductive details in the design of the teaching materials the researchers created did not produce a dominant detrimental effect and, in the majority of participants, were in line with increased understanding.

These findings also align with research that emphasizes that the impact of seductive details is not necessarily detrimental, but rather depends on how they affect learners' attention allocation and information organization. Recent studies, for example, reaffirm that negative effects often arise when learners build mental models around irrelevant details (diversion), which then weakens recall of core content. Therefore, the success of your instructional materials implicitly indicates that most learners still construct adequate representations of the core material despite the addition of engaging details (Rey, 2014)(Kienitz et al., 2023)(Oktama et al., 2026).

The pattern of score changes also suggests heterogeneity in the impact across individuals. Wilcoxon results show that 12 participants experienced an increase in their scores (positive ranks) and 3 participants experienced a decrease (negative ranks), with no similar scores (ties). This variation aligns with the argument that seductive details may work differently depending on learner characteristics and learning conditions, such as initial ability, learning regulation strategies, or the capacity to filter out interesting but irrelevant information. The larger standard deviation of the post-test (SD = 9.80) compared to the pretest (SD = 5.57) reinforces the indication that after the intervention, participants' performance varied more, so future development should ensure that the guiding components (e.g., signaling, step summaries, step-by-step exercises) are strong enough to maintain focus on the main idea for participants who are easily distracted.

Spearman's correlation analysis provides clues to mechanisms relevant to statistical learning. Gain score (XTH; the difference between post-test and pretest scores) was significantly negatively correlated with the pretest ($\rho = -.626$; $p = .013$) and significantly positively correlated with the post-test ($\rho = .671$; $p = .006$). This indicates that participants with lower initial ability tended to experience greater improvement, and the greater the improvement, the higher the final achievement. This finding can be understood as a "room for improvement" effect (participants with lower initial ability have greater opportunity for improvement), and it also suggests that engaging elements in learning materials can be more helpful for students who are not already strong in statistics.

The relationship between cognitive load and learning outcomes in this study is in the direction predicted by cognitive load theory, although it is not yet statistically significant. The post-test correlation with cognitive load (CL.TH) is moderately negative ($\rho = -.438$; $p = .102$), and the relationship between XTH and cognitive load is also negative, approaching significance ($\rho = -.507$; $p = .054$). Substantively, the direction of this relationship suggests that as perceived mental effort increases, score improvement and comprehension tend to decline, which aligns with concerns that engaging details can increase processing that does not directly support learning goals (extraneous load) if left unchecked. Therefore, although the main results show significant increases in comprehension, the integration of high-intensity textual seductive details still needs to be designed with cognitive load management principles, such as limiting the length of details, placing them in sections that do not interrupt core procedural steps, and providing explicit markers of key ideas to be learned.

Overall, this study demonstrates that text-based statistics instruction with high-intensity textually seductive detail can effectively enhance comprehension in the sample of psychology students studied. However, because correlational evidence suggests a potential role for cognitive load and because some participants experienced attrition, the intervention's effectiveness likely depends on the balance between increasing interest and controlling distractions/constructing coherence within the core material.

4. Conclusion

This study concluded that the use of statistics teaching materials developed with the integration of high-intensity textual seductive details effectively improved psychology students' statistical comprehension, as indicated by a significant difference in pretest and posttest scores based on the Wilcoxon Signed-Rank test ($Z = -3.041$; $p = .002$), with the majority of participants experiencing an increase in scores. Furthermore, correlation analysis showed that prior knowledge and cognitive load variables were not significantly related to posttest scores. However, there was a tendency toward a negative relationship between cognitive load and comprehension. This finding suggests that the insertion of high-intensity, seductive textual details can support engagement and comprehension. However, it must be balanced with cognitive load management to ensure that interesting information does not distract from the core material.

Suggestions based on the findings of this study are that developers of statistical teaching materials can utilize high-intensity textual seductive detail as a strategy to increase engagement and comprehension, while still controlling the placement, frequency, and length of details to avoid disrupting the processing of core material and increasing irrelevant cognitive load. Furthermore, instructors/instructional designers are advised to add instructional components that directly support comprehension (e.g., summaries of analysis steps, output examples, step-by-step exercises, and feedback) to keep students' attention focused on key concepts. For further research, it is recommended to use an experimental design with a control

group or randomization, increase the sample size, and separate cognitive load measurements (e.g., distinguishing productive and unproductive loads) so that the mechanism of the influence of textual seductive detail on statistical comprehension can be tested with stronger internal validity.

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