

Procedures for a First-Step Quantitative Study: Exploring Written Fluency

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Getting started in classroom-based quantitative research can be a bewildering and frustrating endeavor without clear direction. In this paper I describe procedures for a project for language teachers interested in learning more about quantitative research methods and gaining valuable practical experience. By following this guide, language teachers working alone or with a small collaborative team will be able to conduct a replication study in their own classrooms that investigates the influence of topic selection methods on written fluency in a free writing activity. After setting research goals appropriate for their instructional setting, teachers follow detailed steps to develop their research plan, execute the study, and complete the data analysis. The successful completion of the project can lead to a manuscript appropriate for smaller in-house publications such as university department journals. Reading recommendations are included to complement the practical activities and help teachers foster development of fundamental knowledge.

語学教師が授業を使って量的研究に着手しようとする時、その煩わしさや苛立ちを回避するためには明確な教示が必要になる。本稿は、量的研究の手法について学び、貴重な実践的経験を得ることに関心を寄せる語学教師が初めて研究に着手するにあたって必要となる詳細を説明したものである。これをガイドとして利用することにより、フリーライティングのトピック選択方法が流暢に書くことと与える影響に関する、単独または小規模なチームによる再現研究の実施が可能になる。より具体的には、それぞれの教育現場に適した研究目標を設定した後、詳細な手順に従って研究計画を立て、調査を実行し、データ分析を完了することになる。プロジェクトがうまく遂行された暁には、それを論文化し、大学の紀要などに投稿することも可能となる。さらにこのガイドには、語学教師の実践活動を補完し、基礎知識の醸成に役立つ文献リストも含まれている。

Getting started in classroom-based quantitative research can be a bewildering and frustrating endeavor without clear direction. Even with an inspired line of inquiry, developing and executing meaningful research can be an enormous challenge. How

should research questions be formulated to best explore the issue? What particular research design is required to provide meaningful answers to those questions? How can the results be interpreted both correctly and objectively? What valid conclusions can be drawn from these results? The answers to these questions may point towards a quantitative approach that encompasses rigid procedural demands based on abstract mathematical concepts. This can form a daunting obstacle for language teachers with limited relevant training and experience and reduce the chance of success for those that just push ahead.

An alternate approach for these language teachers is to temporarily put aside grander research projects and instead focus on small-scale studies that double as professional development opportunities. This paper features a detailed description of a starter project for teachers interested in learning more about quantitative research methods and gaining valuable practical research experience. By following the procedural steps outlined in this guide, teachers working alone or with a small collaborative team will be able to develop their research skills while conducting a replication study in their own classrooms that investigates the influence of topic selection methods on written fluency in a free writing activity.

The original study replicated for this professional development project was selected because the writing activity used for data collection can be incorporated in a range of language classes and does not take up much classroom time. While conducting the study, the teacher can engage in complementary reading of recommended research methods texts in order to understand each step taken and develop a foundation of critical concepts underlying this study that also lie at the heart of quantitative research methods and statistics. The successful completion of the project can lead to a more tangible and professionally valuable goal—a manuscript appropriate for in-house publications such as university department journals.

Exploring the Research Topic

The first step in nearly any research undertaking is the exploration of previous work in the field related to the topic being researched. For this project, that will involve two areas: the topic of the research—fluency in L2 writing—and the research methods used in the study.

Fluency in L2 Writing

This project centers on a partial, modified replication of Bonzo (2008), a study that explored the effects of different methods of selecting topics for a written fluency activity used by university students studying German in the U.S.A. First, this article should be read in full with the intent of understanding all parts of the study, and then key articles from the reference list should be identified, collected, and reviewed. Next, conduct an online search for other relevant literature, particularly articles that are more recent and related more closely to your own instructional setting. Searching for articles that have cited the Bonzo study may help with this task. Appendix A includes a list of some recommended readings. Skeehan (2009) provided a good discussion on the concept of written fluency and fluency in general.

Research Methods

The research design, single sample repeated measures, is basic but useful, and the analysis of the data usually requires a fundamental statistical procedure, the *t* test. Taking time to develop a thorough understanding of these two aspects of the study and other related concepts is highly recommended. Appendix A also includes a list of texts related to research methods and replication research that may be useful, but others can be found online. Seeking out multiple perspectives on the same topic can facilitate comprehension of tricky statistical concepts.

Full comprehension of the steps and the results of your study may require a large amount of work, especially if you have never taken a statistics course. Ideally, you will carefully consider each step in the procedures, review the underlying concepts and logic guiding each step, and develop a thorough understanding of all aspects of the study. The study design is basic relative to large-scale studies; however, it covers an important set of topics for review. If you dedicate yourself to the task and put in the required effort, it is possible to gain extremely valuable insight into much of what guides quantitative research methods.

Planning the Study

Main Research Question

The focus of the Bonzo (2008) study is how variations in a free writing activity can affect student output in terms of a measure of written fluency. He also looked at complexity, but to keep the project manageable, it may be best to stick with the fluency measure. As such, Bonzo's first research question is the main research question for this study.

- RQ1. Does topic-selection control (teacher-selected topics versus participant-selected topics) influence a participant's fluency in writing (as measured with a general fluency index)? (p. 724)

Supplementary Research Questions

Although carefully conducting a study based on answering the above research question will suffice as a meaningful learning activity, it is too restricted to serve as the focus of a full research manuscript. It is highly recommended for teachers interested in writing a research paper to add two or three supplementary research questions. Here are some examples:

- RQ2. How valuable do students see the activity as a language learning exercise?
 RQ3. What topics did students choose to write about when allowed to do so?
 RQ4. What aspects of the writing task do the students feel are most challenging?

Teachers should consider their interests and own classrooms when selecting supplementary research questions. This line of inquiry can add relevancy to manuscripts you intend to publish in department journals. It is recommended that answers to supplementary questions require only the use of descriptive statistics (means, percentages) and basic qualitative data analysis procedures. Questionnaires featuring Likert-scale items and short open-ended questions will work well. Remember to focus your energy on the main research question to keep with the goal of this project as a practical learning experience.

Participants in the Study

The original study (Bonzo, 2008) was focused on university students in the U.S.A. studying German as a foreign language at the intermediate level. This project was designed

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primarily for English teachers at universities in Japan; however, it is certainly possible to do the study with other groups, even those writing in their own native language. A key factor will be how much written language the participants can produce. True beginners in the language with very limited vocabulary will not be ideal participants.

Demographic Data

It is always helpful to collect as much relevant demographic data as you can at the beginning of the study. Participants will need to be described with details that help readers understand key characteristics. It is important to carefully consider your participants and determine aspects that might influence the results of your study and how well they may generalize to other groups. A short questionnaire with Likert items or open-ended questions could be created to collect this data.

Sample Size

Bonzo (2008) had a mixed gender sample of 81 university students from four different classes. In general, the larger the sample size, the less likely you are to draw an erroneous statistical conclusion when analyzing your data. However, determining the fluency index scores for the free writing essays can be time-consuming because it requires transcription of each essay produced by participants. Targeting 30 to 40 participants will usually be sufficient for the statistical needs and help keep the workload manageable. However, if you end up with a smaller sample size, some changes in the analysis procedures, which are discussed later, may be necessary.

Design

Bonzo (2008) had four different groups based on nonrandom assignment participation in the study and used a counter-balanced design with two groups starting with four straight self-selected topics and two groups starting with four straight teacher-selected topics before switching to four straight sessions using the other topic selection method. This design reduces concern of bias due to the order of introducing the topic-selection method. In other words, the effect of the topic-selection method may be obscured if students develop a preference for teacher-selected topics because they are all exposed to this method first or if their writing improves with practice over the duration of the study. For this project, the original design has been adjusted in order to make it easier to conduct in a single classroom, shorter in duration, and, most importantly, simpler in analysis requirements.

Table 1 shows a plan for a pilot session and six data collection sessions (down from eight) with one group (down from four) that alternates weekly in topic selection method:

Table 1. Topic Selection Method by Week

Session	Topic selection method
Pilot	Teacher-selected and Self-selected
1	Teacher-selected: Life after graduation
2	Self-selected
3	Teacher-selected: My friends
4	Self-selected
5	Teacher-selected: Free time
6	Self-selected

Although this adjusted design has weaker controls on the order-effect bias, the issue is still addressed to a certain degree by introducing both topic selection methods on the same day for the pilot and then alternating them on a weekly basis after that. The students may be less likely to get comfortable with one approach when it is not used several sessions in a row. It is important to note that practically all classroom-based studies have limitations and identifiable design weaknesses. Bonzo's original design certainly had them as well: Consider the possibility that the results might change if the four chosen teacher-selected topics were different. When sharing a study in a presentation or a manuscript, the researcher has an obligation to identify important limitations and discuss their potential influence on the results and the strength of the conclusions being drawn. The situation is no different in this case, and in fact, careful consideration of the limitations of the above design and those that arise for each teacher's unique situation will be critical for the research process and the main goal of the project as a learning activity.

It is possible to follow the Bonzo design more closely if you have additional sections of the same course or other classes of similar students and are willing to work through more advanced statistical procedures. However, the remaining sections of this guide are based on the adjusted design.

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Conducting the Study

Preparation

There is a lot of work to be done before the first data collection session. Be organized and have all of these steps completed (not necessarily in this order) well ahead of that first day.

Start a Research Log

Keep a notebook or digital file to record steps, decisions, and issues encountered. This notebook will be valuable when preparing your final write-up.

Explore the Background of the Study

Follow steps described in the previous section of this manuscript.

Adjust Design to Meet Your Needs

Identify classes for data collection. Set schedule for pilot and main data collection sessions. Choose topics for teacher-selected topics. Determine research questions for your study and set procedures to answer those questions.

Obtain Permission from School Administration

Ask colleagues about the need for administrative approval. If formal permission is necessary, follow those steps. Do not jeopardize your standing at your school over a research project.

Prepare Necessary Documents

Create a consent form for student participants, standardized sheets for students' written output, and questionnaires for supplementary data collection. Prepare bilingual versions if your students need them.

Create Database Template

Use a spreadsheet application to create a database in which you can enter all the written and questionnaire data you collect. Detailed instructions for doing this are included later in this manuscript.

Introduce the Activity

You will need to set aside some extra class time to introduce the study and its goals to your students before collecting any data.

Explain the Goals of the Project

Ideally, this will be done in the participants' native language but an explanatory information sheet should be translated ahead of time depending on their English proficiency level.

Participation is Voluntary

Explain that participation in the study is voluntary and anonymous and will not affect their grades. However, if the free writing activity is a part of the class curriculum, students are required to do it. They just need to be given the opportunity to opt out of having you include their writing in the analysis. Make sure each student signs a consent form.

Collect Demographic and Supplementary Data

Administer all questionnaires necessary before the first writing activity is completed. Assign each student an ID for your database. Keep track of absent students, get questionnaires from each student, and make sure all the items on every questionnaire are completed. Absolutely follow up when even a single item is skipped over because this can lead to the student being dropped from the final dataset.

Pilot the Activity

Explain how to do the free writing activity—write as much as possible and do not stop writing during the period (no dictionaries, no planning, no erasing). Do two 5-minute timed writing sessions: one with a teacher-selected topic and one with a student-selected topic. Observe them and make comments about any deviations from the instructions. Collect papers and choose a few to try the initial analysis steps and check the database layout. Make any necessary adjustments before the real data collection sessions.

Conduct the Data Collection Sessions

Try to establish a routine that is used for each data collection session. There should be a brief reminder of the goals and rules of the task, clear instructions about the topic selec-

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tion, and sufficient time for the students to get settled before the activity starts. Collect the writings and organize them promptly. Take notes about the data collection in your research journal and note any unusual or interesting events. Be sure to follow up with absent students to get them to complete the missed data collection in a later class period or at some time when they can be supervised.

Transcribe the Free Writing Responses

If you have the students complete their free writing responses using paper and pencil, you may find the transcription of the responses to be time-consuming. A student assistant will be very helpful for this stage. Having students complete the tasks by typing will save a lot of time as well but add some additional factors to consider when interpreting the results. It will be important to establish a decision-making system for how to enter certain issues you encounter (including words that are misspelled, non-English, scratched out, or illegible) and consistently apply those rules throughout the transcription stage. No specific information about this step was included in the original study, so you will need to have a rationale for the decisions you make.

Analyzing the Data

The first step will be to measure the participants' written fluency based on the essays that they wrote in response to each of the different topics. The measurement stage in quantitative studies is often overlooked by the consumers of research and even the researchers themselves; however, if poorly executed, the study's results can have limited value and lead to unsupported conclusions. A review of discussion on measurement validity in the research methods texts will be very useful as you consider how numbers are being used to represent constructs and how those constructs are defined and observed through written language produced by the participants.

Researchers have employed different ways to define and assess written fluency, and some excellent discussion can be found in Skehan (2009). The technique employed by Bonzo (2008) has been adopted in this replication study, but you should carefully consider its meaning and validity and include this as a part of the discussion section in your manuscript. This fluency index has serious limitations, but it is relatively simple to calculate and provides insight into how such indexes are developed. Again, the main goal of this activity is to develop knowledge and gain experience with quantitative research. Considering the nature of the construct being measured and the weaknesses of the index will be useful in this endeavor.

Fluency Index Formula

For each of the participants' free writing essays, a measure of their writing fluency, a fluency index, is calculated. As represented in Figure 1, it is a ratio of unique words to an adjusted total number of words. You will not need to calculate the fluency scores by hand; this can be done with your spreadsheet application. However, you will need to get counts for total words and total unique words for each free writing essay.

$$F = \frac{U}{\sqrt{2T}}$$

Figure 1. Fluency index formula. F is the fluency score for one particular writing sample; U is the number of unique words in the writing sample; T is the total number words in the writing sample.

Online Text Analyzer

Once the free writing essays have been typed and saved, they can be pasted into an online text analyzer. For example, Lexicool (2017) provides a free text analyzer that works well for this task. This will allow you to see the total number of words and a complete list of unique words. A quick check will allow you to determine if any adjustments need to be made to the count (e.g., a misspelled word should be removed from the unique word count).

Database Template

Using a spreadsheet or statistical application, create a database based on the template included in Appendix B.

Calculate the Fluency Index Scores

A statistical software application will make this step and the rest of the analysis a bit easier if you have access to one. If not, Microsoft Excel will work. See Appendix C for a set of instructions to run this step in Excel. Then, for each student you will calculate a mean of the three fluency scores for the teacher-selected topic writings and a mean of the three fluency scores for the student-selected topic writings.

Main Statistical Analysis

In a typical research project, the statistical procedures for data analysis are guided by the design of the study and determined during the planning stage. Although the original design in the Bonzo study required the use of an ANOVA to analyze the data, the adjusted design for this project leads to a statistical comparison of just two sets of scores from the same group of participants, a situation for which a repeated measures or correlated t test is usually most appropriate. However, the t test, like all statistical procedures, has a certain set of conditions, usually referred to as assumptions, that must be met if the results of the analysis are going to be meaningful. These assumptions relate to how the data were collected and their mathematical properties and procedures exist to check them. Although some violations of these assumptions are permissible, you may need to use an alternative nonparametric version of the t test such as Wilcoxon signed-rank test. If you are working with a small sample size, it may be safest to default to this alternative. It is highly recommended that you spend time carefully reviewing basic concepts in inferential statistics and look closely at the repeated measures or correlated t test in particular.

Once you have reviewed the necessary background and determined the appropriate procedure for the analysis of your data, you can continue with the execution of this step. If you do not have a statistical analysis application, there are free online ones available that will do the job. As an example, see Appendix D for instructions on how to use one of them for a repeated measures t test.

Additional Analyses

Depending on your other research questions and supplementary data, you will run appropriate analyses to summarize the data and create tables to present that data in your analysis. Also, it will be valuable to spend time looking at ways to describe variability of your data: Learning about and reporting statistics like standard deviation and standard error of the mean will help with your understanding of statistics and provide more depth to your analysis. In studies like this that use hypothesis testing methodology, which centers on determination of statistical significance, it is often expected that confidence intervals and some form of an effect size such as Cohen's d are calculated and reported. These steps help other researchers who may want to replicate your study, better understand your results, or discuss the findings in their own manuscripts. Although not done in the original study and not included in the procedures here, it is highly recommended that you spend some additional time to learn about this step and include it in your analysis and discussion if possible.

Interpreting the Findings

Interpretation of the statistical tests and the other data obtained in your study is beyond the scope of this guide. A thorough review of relevant sections of a research methods textbook is strongly advised. Additionally, you can look at the approach used in the original study and other studies that use similar research designs. An abundance of quality information can be found online. It is important to keep in mind that there are always serious limitations to studies we conduct in the classroom. Taking time to understand them, particularly those associated with orthodox hypothesis-testing methodology, will prove extremely beneficial as you build your skills and knowledge as a quantitative researcher.

If you are unable to complete a full review of the concepts underlying the statistical analysis procedures by a certain submission deadline, it is possible to produce a manuscript that reports and discusses only descriptive statistics (means, percentages). Shiobara's (2014) paper features a similar study that does not use any inferential statistics and can serve as a model. This limits the kinds of conclusions you can draw from your study, but seeing the project through to a completed manuscript still provides valuable experience working with quantitative data. It would then also be possible to repeat the study with a different set of students, spend more time on the background reading, and include the full statistical analysis in a second manuscript.

Producing a Manuscript

A critical part in any research endeavor—and an important step in this professional development project—is sharing the findings. Producing a publishable manuscript is an important goal, but it is highly recommended to carefully identify weaknesses in the discussion section, be sure not to overstate the conclusions, and supplement the research goals with discussion of implications for your specific instructional setting. Finally, others are following these same procedures and publishing their own manuscripts—another good reason to personalize your study with a focus on your unique students and setting. Following these steps should produce a manuscript that would be ideal for a limited circulation in-house journal.

Conclusion

By following the procedures in this guide, you can independently complete a small-scale quantitative research study on a relevant topic that can lead to a publishable manuscript. With extra time and energy spent reviewing the logic and concepts guiding the proce-

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dures you use, you can take a meaningful step towards a strong foundation of knowledge and skills in quantitative research methods. Once this study has been completed, this process can serve as a model for other small-scale partial replication studies that relate more closely to your own interests and feature a different research design as a target for you to expand your knowledge base. Taking this careful controlled approach to doing research as professional development can enable you to execute large-scale complex designs to explore any line of inquiry in the long term.

Bio Data

Gregory Sholdt studied educational psychology at the University of Hawaii and currently teaches in the School of Languages and Communication at Kobe University. His interests include professional development for teachers, classroom-based research methods, English for academic purposes, and fluency instruction. He has been exploring innovative approaches to professional development through collaborative classroom research. He currently serves as the chair of the JALT Research Grants Committee and as a consulting editor for *JALT Journal*. <gsholdt@gmail.com>

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Appendix A

Recommended Readings

Fluency in Writing

- Bonzo, J. (2008). To assign a topic or not: Observing fluency and complexity in intermediate foreign language writing. *Foreign Language Annals*, 41, 722-735. <https://doi.org/10.1111/j.1944-9720.2008.tb03327.x>

- Mahmoud Abdel Latif, M. M. (2013). What do we mean by writing fluency and how can it be validly measured? *Applied Linguistics*, 34, 99-105. <https://doi.org/10.1093/applin/ams073>
- Shiobara, F. (2014). Increases in writing fluency through free-writing journals. *Journal of the Faculty of Letters, Kobe Shoin Women's University*, 3, 63-73. <https://doi.org/10.14946/00001428>
- Skehan, P. (2009). Modeling second language performance: Integrating complexity, accuracy, fluency, and lexis. *Applied Linguistics*, 30, 510-532. <https://doi.org/10.1093/applin/amp047>

Quantitative Methods Texts

- Bachman, L. F. (2012). *Statistical analyses for language assessment*. Cambridge, England: Cambridge University Press.
- Brown, J. D. (2004). *Understanding research in second language learning*. Cambridge, England: Cambridge University Press.
- McMillan, J. H. (2012). *Educational research: Fundamentals for the consumer* (6th ed.). Boston, MA: Pearson Education.
- Norris, J. A., Plonsky, L., Ross, S. J., & Schoonend, R. (2015). Guidelines for reporting quantitative methods and results in primary research. *Language Learning*, 65, 470-476. <https://doi.org/10.1111/lang.12104>
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Doing Replication

- Bauerfeind, R. H. (1968). The need for replication in education research. *The Phi Delta Kappan*, 50, 126-128.
- Language Teaching Review Panel (2008). Replication studies in language learning and teaching: Questions and answers. *Language Teaching*, 41, 1-14. <https://doi.org/10.1017/S0261444807004727>
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Appendix B

Creating a Database

See Figure B1 below as a reference for the first stage of the database. One row will be allocated to each participant. Except for the column titles, there should only be numerical

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data in the database. A period (.) should be used to indicate missing data (when a word count could not be calculated or the student did not complete the activity). If you plan to address supplementary research questions, you will want columns for each of those variables as well.

ID	T1T	T1U	T2T	T2U	T3T	T3U	S1T	S1U	S2T	S2U	S3T	S3U

Figure B1. Database template.

Coding Scheme

- ID Unique ID number for each participant.
- T1T Teacher selected topic, essay 1, Total word count
- S2U Student selected topic, essay 2, Unique word count
- .

After calculating the fluency index scores, you can add them to your database. First, add new columns for fluency scores for the six data collection sessions to the end of your database file shown in Figure B2.

These two final columns of scores will be the data used to answer the main research question:

ID	...	T1F	T2F	T3F	S1F	S2F	S3F	TMF	SMF

Figure B2. New columns for fluency scores by selection method.

Coding Scheme

- ID Unique ID number for each participant.
- T1F Teacher selected topic, essay 1, Fluency score
- S2F Student selected topic, essay 2, Fluency score
- TMF Teacher selected topics, Mean of three Fluency scores
- SMF Student selected topics, Mean of three Fluency scores
- .

Appendix C

Calculating a Fluency Index With Excel

Follow these steps to calculate the Fluency Index formula in Excel:

- Click the column header letter of the column that you wish to add the Fluency Index scores.
- In the space for the column formula (fx), put this formula:

$$=C:C/SQRT(2*B:B)$$
 Replace the Cs with the letter of the column of your Unique score.
 Replace the Bs with the letter of the column of your Total score.
- Then hit return while still in the space for the formula.
- Put your cursor over the bottom right of that cell until you see the plus sign (+). Left click and hold it while you drag it down the length of the column to include each row of data entries. That should do it.

Appendix D

VassarStats Online Application

- Follow the link to VassarStats website: <http://vassarstats.net/>
- Select *Statistical Procedure* from left column. Choose: *t Tests & Procedures*
- Click on *Two-Sample t Test for Independent or Correlated Samples*
- Follow procedures described on page.

Directions for Correlated Samples

- For this study, click *Correlated Samples* under *Setup*.

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- Enter or paste the list of the means of the fluency index scores for the teacher selected topics into the Sample A column and the means fluency index scores for the student selected topics into Sample B column. Notice that all your groups (e.g., different classes) are merged together in this analysis. Also, there cannot be an extra return after the last score in the column, the cursor must be on the same row right after the last number in the column.
- Press *calculate*.

Results

- There is a *Print this Window* button at the bottom to print out your results.
- If $p < .05$, then you have found a statistically significant difference.

Example Data Set

Try the numbers in Table D1 to practice the procedures for a correlated *t* test.

Table D1. Example Data Set

ID	Group (class)	Fluency mean	
		Teacher topics	Student topics
1	1	5.0	5.7
2	1	4.7	5.1
3	1	4.8	5.1
4	1	5.7	6.3
5	1	5.8	6.3
6	2	4.5	6.4
7	2	5.0	7.0
8	2	5.5	7.3
9	2	4.7	6.8
10	2	5.7	7.9

Example Results

Data Summary

Sample A $n = 10$, mean = 5.14

Sample B $n = 10$, mean = 6.39

Results

Mean_a - Mean_b = -1.25

$t = -4.91$, $df = 9$, $P_{\text{two-tailed}} = 0.000836$ (Significant)