IJAMSR 2 (6) www.ijamsr.com CrossRef: https://doi.org/10.31426/ijamsr.2019.2.6.612

International Journal of
Advanced Multidisciplinary Scientific Research (IJAMSR) ISSN:2581-4281

Developing Text-Based Scientific Writing through Active Learning for Elementary School Teacher Education Program Students in Surakarta

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Keywords: *active learning, scientific writing, text-based, textbook development*

ABSTRACT

The aims of this research were to describe: (1) the students and lecturer's needs on a scientific writing textbook; (2) the development process of scientific writing textbook model; (3) the effectiveness of the textbook developed; and (4) the dissemination result of the textbook. This research used Research and Development (R and D) method. It was done through four (4) major stages, they were (1) exploration stage, (2) model development stage, (3) model testing stage, and (4) dissemination stage. The research approach used in the exploration stage was descriptive qualitative approach. Data collection was done through in-depth interviews, observation, documentation, and questionnaire. A data analysis technique was done through an interaction analysis model. On model testing stage, experimental research was used.

Citation: *St. Y. Slamet, Retno Winarni, Hartono (2019). Developing Text-Based Scientific Writing through Active Learning for Elementary School Teacher Education Program Students in Surakarta: International Journal of Advanced Multidisciplinary Scientific Research (IJAMSR) ISSN:2581-4281, 2 (6), June, 2019, # Art.1612, pp 7-21*

IJAMSR 2 (6) www.ijamsr.com CrossRef: https://doi.org/10.31426/ijamsr.2019.2.6.612

IJAMSR

International Journal of
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Introduction

This research found out that: (1) in exploration stage, the scientific writing textbooks used in UNS, UMS, and UNISRI Surakarta have not met the students and lecturers' need; (2) in the model development stage, it is produced a text-based scientific writing textbook through preliminary field testing; and (3) in model effectiveness testing through main field testing, it is found out that the t score (0.17) is higher than t-table for N=90 and α= .05 (1.64) which means the hypothesis is accepted (H_0 was rejected) and the research was stated significant. It could be concluded that the text-based scientific writing textbook was effective to improve the students' scientific writing ability.

Writing is a complex skill that involves cognitive activity and needs to utilize graphology, vocabulary, sentence structure, paragraph development, and language logic. Writing requires provision of knowledge about what will be written, for whom the writing is written, and must be skilled and flexible in communicating it. Writing skill is not a talent, but a skill that can be processed through practice. No matter how much someone's talent for writing, if this talent has never been trained it will not develop. Therefore, writing skill must be learned and practiced. By its nature, writing is a productive and receptive skill (Graham et al., 2012: 7; Leo, 2010: 6; Wagiran and Doyin, 2010: 2).

Scientific writing is an essay of science that presents facts and is written according to proper and correct writing methods. Scientific writing must be written honestly and accurately based on the truth. The truth in a scientific wriring is not a normative truth, but an objective and positive truth in accordance with facts and data in the field (Wardani, IGAK, Aminudin Zuhairi, and Sardjiyo, 2007: 1.6).

The students and lecturers' low level of scientific writing was reported by the Director General on Community Development, Research and Service (Anshori, 2012: 2). This is proofed from the low number of scientific journal publications. For this reason, the students' ability to write scientific work needs to be improved.

In general, students experienced various difficulties in writing scientific papers. These difficulties include: (1) finding topics or problems to be written, (2) finding reference material, (3) compiling effective sentences, (4) compiling good paragraphs, and (5) mastering

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International Journal of
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the technique of writing scientific papers (Maslakhah, 2005: 20). Some of these difficulties still occur today.

For this reason, this research is important to help and guide students in writing scientific papers. Based on exploration studies, lecturers and students need a textbook on scientific writing. The use of the textbook is expected to be appropriate and in accordance with the students' needs.

By text-based, students use language not only as a means of communication, but as a means of developing thinking skills. Therefore, text-based learning needs to be understood by lecturers, students, and related parties. It is accurate that the text-based scientific writing textbook is used by Surakarta ESTEP students to improve their ability to write scientific papers.

Silberman describes when active learning, students do many activities. They use the brain to learn ideas, solve problems, and apply what they learn. According to Lorenzen (2001: 19) active learning is a method in educating or inviting students to actively participate in class. Active learning aims to optimize the use of all the potential possessed by students, so that all students can achieve satisfying learning outcomes according to their personal characteristics.

Cherney's (2008) study concluded that the application of active learning was based on the level of the program, material, type of student, type of class, and discussion needed by students to improve understanding of the material. The application of active learning is needed to improve the material for playing theater skills. Research conducted by Meyers & Jones (1993) proves that through the application of active learning strategies, students can express in four domains of language skills namely, listening, speaking, reading, and writing.

Textbooks are learning media that are used to support a teaching program both at school and in college. Textbooks are all things that can facilitate learning in the teaching and learning process. Textbooks contain specific material in certain fields of science that are used as guidelines for learning and teaching in schools. (Buchingham in Taylor, 1988: 1523; Richards & Rodgers, 2002: 550; Tomlinson, 2012: 143). In order to fulfill text-based scientific writing textbook, this research is urgent and needs to be done immediately in the ESTE

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Undergraduate Program in Surakarta.

RESEARCH METHOD

Research and development is a process used to develop and validate educational products. Development research as a systematic assessment of design, development and evaluation of programs, processes and learning products that must meet the criteria of validity, practicality, and effectiveness (Borg and Gall, 2007: 772; Seals and Richey, 1994: 75). Research and development includes 10 steps, namely: (1) exploration, (2) planning, (3) design, development, (4) preliminary field test, (5) revision of preliminary field test results, (6) main field test, (7) revisions to the results of main field tests, (8) feasibility tests, (9) final revisions to the results of feasibility tests, and (10) dissemination and implementation of final products. The ten steps are summarized into 4 main stages, each of which includes several operational steps. The four steps are: (1) the exploration stage, (2) the stage of model development, (3) the stage of testing the model, and (4) the stage of dissemination and implementation of the model (Borg and Gall; 2007: 775-776; Sukmadinata, 2010: 182 -189; Nurkamto, 2012: 2-5).

The exploration stage was carried out through in-depth study on the implementation of Indonesian Language learning in ESTEP students in Surakarta. The purpose of this activity is to analyze the needs of students and lecturers on scientific writing textbook which is considered capable of improving the students' scientific writing ability optimally. This research approach uses qualitative descriptive. The data sources used are 5 students and 5 lecturers, the learning process of scientific writing, learning process in the classroom, and documents or archives. Data collection techniques used are documented, observation, in-depth interviews, and questionnaires. Data analysis used was an interaction analysis model carried out in 2 stages; during data collection and after data collection (Miles and Huberman, 1992: 16-20; Sutopo, 2002: 95-96).

The model development procedure used is the Glanz model theory guide, which includes: data collection, analysis, data interpretation, reflection actions, and modifications. In addition, the Zuber-Skeritt model was also used, which includes: careful planning, planning, implementation, observation, testing, evaluation, critical analysis of the results of the implementation, and determining the next cycle (Borg and Gall, 2007: 578; 585-590).

The development process was done by testing the prototype textbook model in the field through preliminary field testing and main field testing. Preliminary field testing was conducted by ESTE students of Sebelas Maret University. Main field testing was conducted by ESTE students of Muhammadiyah Surakarta University and Slamet Riyadi University.

Data collection techniques used were documented analysis, participant observation, in-depth interviews, tests, and focus group discussions. Data analysis was carried out in two ways; qualitatively and quantitatively. The model that has been tested was then consulted with experts aiming that the textbook model developed has substantive truths and qualities. Validation was carried out by Prof. Dr. Herman J. Waluyo, M.Pd. (literary expert) lecturer at Sebelas Maret University Surakarta.

The model testing phase was aimed to examine the effectiveness of the Text-Based Scientific writing textbook model in improving the students' scientific writing ability. Model testing was done by conducting experimental research. The type of experimental research used was quasi-experimental research. The experimental research design chosen was Quasy-experimental Nonequivalent Before-after Design Model (Wiersma, 1986: 143-144; Cohen et al, 2000: 216; Sugiyono 2013: 302-305; Gall, Gall, & Borg; 2007: 381).

The experimental class used to be 90 ESTE students of Sebelas Maret University. The control class was 85 ESTE students from Muhammadiyah Surakarta University and Slamet Riyadi University Surakarta. The aim of this study was looking at the main effects of the treatment variables on the students' scientific writing ability.

The data collection technique used was the test of the scientific writing ability. The research data analysis was carried out through two stages; the requirements test (normality test, homogeneity test, and balance test) and the effectiveness test of the model (independent t-test). The output of the model testing stage is the Text-Based Scientific writing textbook that has been tested in a process and productive manner.

The dissemination stage was done through socializing the Text-Based Scientific writing textbook that has been developed. The textbook can be implemented in the Scientific

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Writing learning process, especially in the ESTE program in Surakarta area. The dissemination results were disseminated through international seminars, writing articles in international journals, and publishing the textbook developed.

RESULT AND DISCUSSION

Based on the findings at the exploration stage, it can be concluded that there are problems in learning to write scientific works in the ESTEP. The problems are, (1) the absence of scientific writing textbooks, (2) lack of action to improve students' scientific writing skills, (3) lecturers lack of understanding of the scientific writing material, and (4) lecturers have not used innovative learning models. In principle, they (students, lecturers, and policy makers) agree that the scientific writing textbook needs to be produced. Furthermore, based on the analysis of the students and lecturers' needs, the following results are obtained: (1) scientific writing textbook (text-based) need to be arranged to facilitate and guide students to improve their scientific writing skills, (2) active learning procedures need to be applied as a solution to the saturation of students in monotonous and non-varied lectures; and (3) facilitating examples of scientific essay texts to help students to improve their scientific writing skills.

Based on the findings at the exploration stage, which included an analysis of the students and lecturers' needs, there were six efforts carried out at this stage of development. These efforts are; (1) the development of a prototype model into a scientific writing textbook model, (2) the results of prototype model development based on expert judgment, (3) the results of model development and improvement based on preliminary field testing in ESTEP UNS Surakarta, (4) the results of model development based on the main field testing at ESTEP UMS and UNISRI Surakarta, (5) determination of textbook models in ESTEPs of Surakarta, and (6) conclusions on the development results of Scientific Writing textbook model in ESTPs in Surakarta.

The data of this study are the score of the ESTE students' scientific writing ability, both for the experimental class and the control class. In the experimental class there were 90 respondents who came from the ESTE students of Sebelas Maret University, they were given treatment through applying the developed textbook in the learning process through active learning. In contrast, in the control class there were 85 respondents from ESTE students of UMS Surakarta who used the old textbook in the learning process.

Referring to the explanation above, it means that the total respondents were 175 in this study; 90 respondents in the experimental class, and 85 other respondents in the control class. In the experimental class and the control class, all respondents were given a test of the scientific writing ability at the beginning (pre-test) before the experimental treatment was carried out. Meanwhile, after treatment, all respondents were tested again, which was called post-test at the end of the experiment.

Based on the explanation above, the description of the research data was grouped into 6 (six) groups, namely: (1) pre-test score data of the experimental class; (2) post-test score data of the experimental class; (3) pre-test – post-test score gap of the experimental class (4) pre-test score data of the control class; (5) post-test score data of the control class; and (6) pre-test – post-test score gap of the control class. Each group of research data was described statistically which include: (1) central tendencies: mean, median, mode; (2) spread tendency: variance, and standard deviation; (3) the highest score; (4) the lowest score; (5) range; (6) score frequency distribution; and (7) histogram image.

a. Pre-Test Score Data Of The Experimental Class

Based on descriptive analysis conducted with the Excel 2013 program, data on the pre-test score of the experimental class reported as follows: (1) central tendency: mean = 68.81, mode = 67, and median = 68; (2) spread tendency: variance = 11.89 and standard deviation = 3.45; (3) highest score = 77; and the lowest score = 59; (4) range = 18.

The frequency distribution of the pre-test score data of the experiment class was obtained through the following calculation stages:

i. Determine the range, by subtracting the highest score with the lowest score. The highest score is 77 while the lowest score is 59. It obtains a value of range = 18;

ii. Determine the interval classes. In this study 5 interval classes were applied;

iii. Determine the length of the interval class by dividing the range value of the interval classes, 18: 5 = 3.6 which is then rounded to 4.

iv. Choose the lower end of the first interval class. This is done by taking the lowest score. Therefore, the first interval class starts with a score of 59.

Based on the stages above, the frequency distribution of the pre-test score data of the experiment class can be seen in Table 1 below.

Table 1. The frequency distribution of the pre-test score data of the experiment class

Interval Class	Absolute Frequency (f_{abs})	Relative Frequency (%) (f_{rel}.)
59 – 62	3	3,33
63 – 66	19	21,11
67 – 70	39	43,33
71 – 74	24	26,67
75 – 78	5	5,56
	90	100,00

b. Post-test score data of the experimental class

Based on descriptive analysis conducted with the Excel 2013 program, data on the post-test score of the experimental class reported as follows: (1) central tendency: mean = 77.68, mode = 75, and median = 77; (2) spread tendency: variance = 23.97 and standard deviation = 4.90; (3) highest score = 88; and the lowest score = 68; (4) range = 20. As the stages of preparing the frequency distribution of the pre-test score of the experimental class explained before, by doing the same calculation, the preparation of the frequency distribution of post-test scores of the experimental class was obtained: (1) range = 88-68 = 20; (2) interval classes were set 6; (3) interval class 20: 6 = 3.33 rounded up to 4; and (4) the lower end of the first interval class starts from the smallest data: 68.

Based on the information above, the frequency distribution of the post-test score data of the experiment class can be seen in Table 2 below.

Table 2. The frequency distribution of the post-test data of the experiment class Mahasiswa pada Kelas Eksperimen

Interval Class	Absolute Frequency (f_{abs})	Relative Frequency (%) (f_{rel}.)
68 – 71	9	10,00
72 – 75	26	28,89
76 – 79	23	25,56
80 – 83	18	20,00
84 – 87	13	14,44
88 – 91	1	1,11
	90	100,00

IJAMSR 2 (6) www.ijamsr.com CrossRef: https://doi.org/10.31426/ijamsr.2019.2.6.612

International Journal of
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Based on descriptive analysis conducted with the Excel 2013 program, data on the pre-test – post-test score gap of the experimental class reported as follows: (1) central tendency: mean = 8.87, mode = 6, and median = 8.5; (2) spread tendency: variance = 13.76 and standard deviation = 3.71; (3) highest score = 17; and the lowest score = 2; (4) range = 15. As the stages of preparing the frequency distribution explained before, by doing the same calculation, the preparation of the frequency distribution of pre-test – post-test score gap of the experimental class was obtained: (1) range = 17-2 = 15; (2) interval classes were set 6; (3) interval class 15: 6 = 2.5 rounded up to 2; and (4) the lower end of the first interval class starts from the smallest data: 2.

Based on the information above, the frequency distribution of the pre-test – post-test score gap of the experimental class can be seen in Table 3 below.

Table 3. The frequency distribution of the pre-test – post-test score gap of the experimental class

Interval Class	**Absolute Frequency (f_{abs})**	**Relative Frequency (%) ($f_{rel.}$)**
2 – 4	10	11,11
5 – 7	25	27,78
8 – 10	27	30,00
11 – 13	17	18,89
14 – 16	7	7,78
17 – 19	4	4,44
	90	100,00

d. **Pre-test score data of the control class**

Based on descriptive analysis conducted with the Excel 2013 program, data on the pre-test score of the control class reported as follows: (1) central tendency: mean = 63.81, mode and median = 63; (2) spread tendency: variance = 12.70 and standard deviation = 3.56; (3) highest score = 72; and the lowest score = 54; (4) range = 18. As the stages of preparing the frequency distribution of the pre-test score of the experimental class explained before, by doing the same calculation, the preparation of the frequency distribution of pre-test scores of the control class was obtained: (1) range = 72-

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54 = 18; (2) interval classes were set 5; (3) interval class 18 : 5 = 3.6 rounded up to 4; and (4) the lower end of the first interval class starts from the smallest data: 54.

Based on the information above, the frequency distribution of the post-test score data of the experiment class can be seen in Table 4 below.

Table 4. The frequency distribution of the pre-test score data of the control class

Interval Class	Absolute Frequency (f_{abs})	Relative Frequency (%) ($f_{rel.}$)
54 – 57	4	4,71
58 – 61	18	21,18
62 – 65	37	43,53
66 – 69	20	23,53
70 – 73	6	7,06
	85	100,00

e. **Post-test score data of the control class**

Based on descriptive analysis conducted with the Excel 2013 program, data on the post-test score data of the control class reported as follows: (1) central tendency: mean = 72.78, mode = 70, and median = 73; (2) spread tendency: variance = 13.36 and standard deviation = 3.67; (3) highest score = 80; and the lowest score = 65; (4) range = 15. As the stages of preparing the frequency distribution explained before, by doing the same calculation, the preparation of the frequency distribution of post-test score data of the control class was obtained: (1) range = 80-65= 15; (2) interval classes were set 6; (3) interval class 15: 6 = 2.5 rounded up to 2; and (4) the lower end of the first interval class starts from the smallest data: 65.

Based on the information above, the frequency distribution of the post-test score data of the experiment class can be seen in Table 5 below.

Table 5. The frequency distribution of the post-test score data of the experiment class.

Interval Class	Absolute Frequency (f_{abs})	Relative Frequency (%) ($f_{rel.}$)
65 – 67	6	7,06
68 – 70	22	25,88
71 – 73	20	23,53
74 – 76	20	23,53
77 – 79	16	18,82
80 – 82	1	1,18
	85	100,00

f. Pre-test – post-test score gap of control class. Based on descriptive analysis conducted with the Excel 2013 program, data on the pre-test – post-test score gap of the control class reported as follows: (1) central tendency: mean = 8.96,

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mode = 8, and median = 9; (2) spread tendency: variance = 11.92 and standard deviation = 3.45; (3) highest score = 17; and the lowest score = 2; (4) range = 15. As the stages for preparing the frequency distribution explained before, by doing the same calculation, the preparation of the frequency distribution of pre-test – post-test score gap of the experiment class was obtained: (1) range = 17-2 = 15; (2) interval classes were set 6; (3) interval class 15: 6 = 2.5 rounded up to 2; and (4) the lower end of the first interval class starts from the smallest data: 2.

Based on the information above, the frequency distribution of the pre-test – post-test score gap of the experimental class can be seen in Table 6 below.

Table 6. The frequency distribution of the pre-test – post-test score gap of the control class

Interval Class	Absolute Frequency (f_{abs})	Relative Frequency (%) ($f_{rel.}$)
2 – 4	8	9,41
5 – 7	22	25,88
8 – 10	29	34,12
11 – 13	18	21,18
14 – 16	4	4,71
17 – 19	4	4,71
	85	100,00

2. Requirement Analysis Testing

Inferential data analysis to prove whether the research hypothesis is accepted or rejected used statistical tests with independent t-test. Data analysis with this statistical technique requires several requirements regarding the data to be analyzed. These requirements include: (a) data normality test, (b) homogeneity of variance test, and (c) balance test.

Data normality test was carried out using the Lilliefors test technique. Meanwhile, the homogeneity of variance test was carried out using the Bartlett-test technique; and the balance test was carried out by an independent t-test technique.

a) Data Normality Test

As mentioned in the statement above, the data tested for normality in this study are two, namely (1) data on pre-test – post-test score gap in the experimental class, and (2) data on pre-test – post-test score gap in the control class. The following are the results of the normality test for the two groups of data above.

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i) Normality Test Result on pre-test – post-test score gap data in the experimental class

Normality Test Result on pre-test – post-test score gap data in the experimental class obtained the maximum Lo of 0.0910. Based on the critical L table for Lilliefors test with n = 90 dan real level α = 0.05, it was obtained Lt = 0.0934. Based on the above comparison, it could be concluded that Lo was lower than Lt, which means that the pre-test – post-test score gap data in the experimental class comes from populations that were normally distributed.

ii) Normality Test Result on pre-test – post-test score gap data in the controller class

Normality Test Result on pre-test – post-test score gap data in the control class obtained the maximum Lo of 0.0927. Based on the critical L table for Lilliefors test with n = 75 dan real level α = 0.05, it was obtained Lt = 0.0961. Based on the above comparison, it could be concluded that Lo was lower than Lt, which means that the pre-test – post-test score gap data in the control class comes from populations that were normally distributed.

b) Homogeneity of variance test

This homogeneity of variance test was conducted to test the similarity of variance between the pre-test – post-test score gap in the experimental group and the control group. The statistical technique used for this purpose is the Bartlett test technique. This test is intended to test the null hypothesis (H0) which states that between the variance of the pre-test – post-test score gap of the experimental group and the variance of the pre-test – post-test score gap of the control group was homogeneous at the real level α = 0.05, against the counter hypothesis (H1) which states that between the variety of pre-test – post-test score gap of the experimental group and the control group, there was not homogeneous at the same real level.

The test criteria used are that H0 is rejected if it turns out the value of is smaller or equal to at the real level α = 0.05. Conversely, if the value at the real level α = 0.05, then H0 which states the scorethe variance of score is homogeneous is accepted.

International Journal of Advanced Multidisciplinary Scientific Research (IJAMSR) ISSN:2581-4281 Volume 2, Issue 6, June, 2019

IJAMSR 2 (6) www.ijamsr.com CrossRef: https://doi.org/10.31426/ijamsr.2019.2.6.612

International Journal of
Advanced Multidisciplinary Scientific Research (IJAMSR) ISSN:2581-4281

The homogeneity of variance test of the pre-test – post-test score gap in the experiment class, and the pre-test – post-test score gap in the control group resulted in = 0.46. Based on the chi-square distribution table with df (degree of freedom) 1 and the real level α = 0.05 obtained = 3.84 which is much greater than . Thus, based on the testing criteria, the null hypothesis (H0) which states that the variance of the pre-test – post-test score gap of the experimental class and the controller class is homogeneous. It means that the variance of the pre-test – post-test score gap of both groups is homogeneous.

c) **Balance Test Result**

The balance test aims to test the average equation of the students' ability to play theater between the experimental group and the control group. The statistical test used is the t-test with a real level α = 0.05. The hypothesis proposed: H0 if the value of tcount> ttable then the variance in the score of the both groups is not balanced. H1 if the value of tcount <ttable then the variance in the score of the both groups is balanced. The test results show the value of tcount = -0.0037 <t table = 1.645. The conclusion is that the average score of the students' ability to play theater in the experimental group is the same as the control group.

3. **Hypothesis Testing**

Hypothesis testing here was intended to find out whether the null hypothesis (Ho) proposed is rejected, or vice versa at a certain level of confidence the alternative hypothesis (H1) submitted is accepted. In accordance with what was mentioned in the previous section, the research hypothesis was tested using independent t-test statistical techniques. The statistical analysis technique was used to see differences in the effect (effectiveness) of the use of Text-Based Scientific Writing textbook model through active learning, with those who did not use the textbook model (at the time before the experiment was conducted).

The effectiveness of using Text-Based Scientific Writing textbook through active learning to improve the ESTE students' scientific writing ability in Surakarta (UNS and UMS) has been verified.

Based on statistical analysis with an independent t-test technique, it is obtained t-count of 0.17. Meanwhile, the critical area (ca): t (0.05: 173) is 1.64 so that ca {t <-1.64 or t>

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1.64} and t = 0.17 is lower than ca so Ho: µ1 ≠ µ2 is accepted. Thus, there is a significant difference between the ESTE students' scientific writing ability for those who were taught using the Text-Based Scientific writing textbook model through active learning, with those who were taught using old textbook. In other words, it can be concluded that the Text-Based Scientific Writing textbook model through active learning can improve the ESTE students' scientific writing ability.

The application of active learning is highly supported the Indonesian language learning to improve the scientific writing ability optimally. Cherney (2008) concluded that the application of active learning based on program level, material, type of student, type of class, and discussion is needed to improve the material understanding, in this case productive language skills. Meyers & Jones (1993) concluded that through the application of active learning strategies, students can express four domains of language skills; listening, speaking, reading, and writing. Thus, the application of active learning in Scientific Writing subject using Text-Based Scientific Writing textbook is effective in improving the students' scientific writing ability.

CONCLUSION

The exploration stage showed that scientific writing textbooks used in the ESTE undergraduate program of UNS, UMS, and UNISRI Surakarta were not yet in accordance with the students and lecturers' needs. The model development phase produces a Text-Based Scientific Writing textbook through the preliminary field testing. The effectiveness testing phase of the Text-Based Scientific Writing textbook was done through main field testing. The value of t obtained is equal to (0.17) with the critical area (ca): t (0.05: 173) = 1.64; ca {t <-1.64 or t> 1.64} and t = 0.17 < ca so that Ho: µ1 ≠ µ2 is accepted. The dissemination stage was done through socializing the Text-Based Scientific Writing textbook in international seminars, international journals, and publishing the proposed textbook with ISBN. Text-Based Scientific Writing textbook is effective in improving the students' scientific writing ability. The textbook can be accepted by lecturers, policy makers, and students as teaching materials.

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