The Effect of AES System on Writing Metacognitive Strategy in Senior High School EFL Writing

Taking Nanchong First Middle School as an Example

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Abstract—Since 1960s, the Automatic Essay Scoring （here after will be called AES） for students' writing has appeared abroad; China began to conduct some research of AES system in the latest 20 years, and most of them are concentrated on higher education. Many studies show that students' autonomous writing ability has great connection with their writing metacognitive strategy. This study attempts to apply the AES system to senior high school's English Writing Teaching, in order to understand the application of the AES system in English writing teaching in senior high school, and to observe the effect of the writing metacognitive strategy of senior high school students.

Keywords—English writing AES system; senior high school students; English writing metacognitive strategy; effect

I. INTRODUCTION

According to "2016 General College Entrance Examination (Sichuan volume) English Examination Instructions", writing is in the fourth part and it accounts for 25 scores. It requires candidates to write a short passage of about 100 words in English according to the given situation. The given situation includes purpose, object, time, place, content and so on and the forms that the situation provides are chart, outline and so on. And the scores will be given in the following aspects: content integrity, number of characters, structural requirement, spelling and punctuation, handwriting. In fact, most students don't have enough experience and techniques to write a composition both fluent and authentic in accordance with the requirements of the college entrance examination within the stipulated time. In this way, writing is always an indispensible part of high school English teaching. It is not only an effective way to check students' English learning situation, but also a useful way to improve their autonomous learning ability and logical thinking ability. English writing also have been attracted much attention in second language teaching and researching.

II. DEFINITION AND LITERATURE REVIEW

This chapter will explain some related theories of senior high school English writing and some previous studies related to this study from home and abroad.

A. Writing Metacognitive Strategy

Psychologist Flavell (1979) proposed the concept of metacognition. He points out that metacognition is the subjects' cognition to their cognitive process, cognitive result and related activities. Metacognitive strategy is the learning strategy under the guidance of metacognitive theory. O' Malley & Chamot said: "the metacognitive strategy is the knowledge of cognitive process, learners use some methods like planning, monitoring and evaluation to adjust the cognitive process, and the specific strategies including planning ahead, selective attention, self-management, self-monitoring and self-evaluation." (1990)

B. Automated Essay Scoring

Automated Essay Scoring (AES), also known as Automated Writing Evaluation (AWE) or Automated Essay Evaluation (AEE), is defined by Ericsson and Haswell (2006) as "a kind of computer-based instructional tool that focuses on writing assistant purpose rather than only on scoring function". The United States is the first country to develop automated essay scoring system, so the studies about AES system stared in America firstly.

C. Studies of Writing Metacognitive Strategy on the Basis of AES System from Home and Abroad

Although the study of Automated Essay Scoring is quite mature abroad, China started to have few studies in the late 1990s. Most of the studies of AES system are taken it as a teaching aid to participate in English writing teaching. Especially in university English writing teaching, educators did innovative education experiments through AES system. Yang Xiaoqiong (2015) did an empirical study of university students' self-efficacy under the autonomous writing teaching mode based on AES, and Yang got the result that this mode can improve students' English writing and their self-efficacy. Chen Jianchun (2015) and Liu Yanyan (2015) also did the researches of AES's influence on university students' English writing self-efficacy.

After all the previous studies mentioned above, it is clear to see that AES system is widely used in western schools and some Chinese universities. And educators not only studied AES systems in the aspect of their development, but also did

many empirical studies on their application in schools. Some of them trying to answer the question of what kind of impact AES system will cause to students' learning psychology. And among different psychological factors, educators proved the interrelation between English writing metacognitive strategy and self-efficacy. As two important elements of English writing, will the application of AES system have an impact on students' English writing metacognitive strategy and self-efficacy? Because of the vacancy of this area, the author decided to do the empirical study of it.

III. RESEARCH METHODOLOGY

This research spends four months and there were 51 students in Class 9, Grade 1 participated in it. Taking students' English writing essays on Jvku (automated essay scoring system) as samples, the author aims at studying AES's influence on students' English writing metacognitive strategy, self-efficacy and output qualify through analyses the data of questionnaires, interviews and writing scores.

A. Research Questions

This study aims to demonstrate two questions:

- Does AES system develop high school students' English writing metacognitive strategy?

- Does the change of writing metacognitive strategy affect the output quality of students' English compositions on the basis of AES system?

B. Subjects

Fifty one senior students of grade one in Nanchong First Middle School have participated in the research as subjects. All of them came from class 9 and in the age from fifteen to sixteen. They have studied English for at least six years and none of them have used AES system for English writing before. Fifty-one students are all involved in the eight times' writing training on Jvku AES system and the twice questionnaires (pre and after).

C. Research Instruments

1) Writing tests: The writing tests part of this research includes two tests, which both take on Jvku system and scored by teachers and the system, and another six writing tasks. As for manual evaluation by teachers, the author adopted the 2015 and 2016's English writing scoring criteria of College Entrance Examination in Sichuan to ensure the authenticity and practicability. It means the final scores of the two times' tests will be the combination of the two evaluations. The first pre-test took in the beginning of the research and the after-test took in the end of the research which lasted nearly four mouths.

2) Questionnaire: The questionnaire used in the research are the essential instrument to collect the raw data of the changes of students' English writing metacognitive strategy. The author take O' Malley and Chamat's metacognitive strategy classification system (2001) and Lu

Wenjun's (2006) questionnaire as references to design the questionnaire. The questionnaire is designed to know the changes of students' English writing metacognitive strategies after the experiment of using Jvku AES system. This questionnaire also has four different aspects of English writing metacognitive strategies: planning ahead, selective attention, self-monitoring and self-evaluation.

3) Jvku AES system: Jvku AES system is the basic instrument in this research, because this research was rely on this AES system. The writing tasks will be given every two weeks, and every writing task should finally write on Jvku AES system to get scored and be recorded.

D. Research Procedures

This research begins on September 8th of 2016 and ended on December 15th of 2016, which continues 14 weeks. And this research conducts the pre-test of English writing, pre-test of questionnaires, six English writing tasks on line with Jvku AES system, after-test of English writing and after-test of questionnaire in a strict order.

IV. RESULTS AND DISCUSSION

A. The Descriptive Results of Questionnaire

The questionnaire was taken before and after the experiment and it took in the class 9 with 51 students. In this part, it mainly analyzes the data from the following ways: students' general attitude; students' metacognitive strategies towards English writing.

In order to know students' metacognitive strategies towards English writing, the writer designed another questionnaire with 24 questions. These questions can be divided into four groups: planning ahead, selective attention, self-monitoring and self-evaluation. In the questionnaire, each multiple choice has five options: "1=strongly disagree", "2=disagree", "3= neither disagree nor agree", "4=agree", "5=strongly agree". And the analysis of item 1-6 is displayed in "Table I".

TABLE I. RESULTS OF QUESTIONNAIRES BEFORE AND AFTER THE EXPERIMENT (QUESTION 1-6)

Questions	Strongly disagree (B/A)	Disagree (B/A)	Neither disagree nor agree(B/A)	Agree (B/A)	Strongly agree(B/A)
Question 1	21.6%/23.5% 11/12	29.4%/23.5% 15/12	43.1%/43.1% 22/22	2%/2% 1/1	3.9%/7.8% 2/4
Question 2	23.5%/15.7% 12/8	35.3%/21.6% 18/11	29.4%/37.3% 15/19	9.8%/15.7% 5/8	2%/9.8% 1/5
Question 3	9.8%/5.9% 5/3	19.6%/15.7% 10/8	49%/37.3% 25/19	11.8%/25.5% 6/13	9.8%/1.7% 5/8
Question 4	15.7%/7.8% 8/4	23.5%/11.8% 12/6	39.2%/33.3% 20/17	13.7%/31.4% 7/16	7.8%/15.7% 4/8
Question 5	15.7%/7.8% 8/4	17.6%/7.8% 9/4	39.2%/29.4% 20/15	15.7%/33.3% 8/17	11.8%/21.6% 6/11
Question 6	11.8%/5.9% 6/3	13.7%/0% 7/0	21.6%/13.% 11/7	35.3%/21.6% 18/11	17.6%/58.8% 9/30

The first six questions are about their English writing metacognitive strategies of planning ahead. The first question is "I will make an English writing plan before writing.", and most students choose neither disagree nor agree. Only 3 students agree (include strongly agree) this question before the experiment. After the experiment, the number raised to 5 students (proportion is 9.8%). Question 2 is "I will set an aim for English writing." which have the same situation with the first one. Although students who agree with this question have improved after the experiment, it still makes up a small proportion. This number shows that most students still can't have overall plan about the topic and structure before the writing.

Questions 3 to 6 are asking about students' basic preparation (materials accumulation) before English writing.

Question 3 is "I will recite frequently used words and phrases to enlarge my vocabulary and broaden my knowledge", 27.2% of the students agree it after the experiment, which had had increased 5.6%. Question 4 is "I will recite English transitional words and sentences in order to use them while writing." 47.1% of the students express that they agree with it after the experiment. The question 5 is "I will recite English sentences and paragraphs that I have read." Over half of the participants agree with it which had raised 27.4%. Question 6 is "I will recite English sample essays." Forty-one students express that they would recite English sample essays after the experiment. From this result, it shows that the autonomous mode of English writing based on Jvku AES system is worked for students' English writing metacognitive strategies on planning ahead.

TABLE II. RESULTS OF QUESTIONNAIRES BEFORE AND AFTER THE EXPERIMENT (QUESTION 7-12)

Questions	Strongly disagree(B/A)	Disagree (B/A)	Neither disagree nor agree(B/A)	Agree (B/A)	Strongly agree(B/A)
Question 7	11.8%/11.8% 6/6	21.6%/15.7% 11/8	43.1%/35.3% 21/18	13.7%/21.6% 7/11	11.8%/15.7% 6/8
Question 8	7.8%/3.9% 4/2	21.6%/2% 11/1	29.4%/15.7% 15/8	19.6%/43.1% 10/21	21.6%/37.3% 11/19
Question 9	7.8%/3.9% 4/2	13.7%/2% 7/1	31.4%/25.5% 16/13	37.3%/47.1% 19/24	9.8%/21.6% 5/11
Question 10	15.7%/5.9% 8/3	11.8%/5.9% 6/3	45.1%/37.3% 23/19	23.5%/35.3% 12/18	3.9%/15.7% 2/8
Question 11	3.9%/3.9% 2/2	13.7%/0% 7/0	35.3%/19.6% 18/10	23.5%/29.4% 12/15	23.5%/47.1% 12/24
Question 12	11.8%3.9% 6/2	19.6%/11.8% 10/6	37.3%/35.3% 19/18	23.5%/29.4% 12/17	7.8%/15.7% 4/8

Questions 7-12 are asking about students' English writing metacognitive strategies of selective attention. Results are shown in "Table II". Question 7 is "Before I begin my English writing, I will relate the background knowledge to help me to write." Thirteen students agree it before the experiment and the support proportion is 25.5%. After the experiment, the proportion raised to 37.3%. Question 8 is "I will carefully read the topic of English writing, understand clearly and then write it around the topic." Question 9 is "I will try my best to use the words, phrases and sentence patterns in the process of writing." The question 11 is "I will notice if I use punctuation, capital/lower-case letters correctly." Over half of participates agree with the questions after the experiment.

Question 10 is "I will try my best to layout each paragraph and pay attention to the structure of the article." Question 12 is "I will use the transitional words reasonably,

so that the article can be logically connected." The results of these two questions have quite less percentage of agreement comparing with other questions. Before the experiment, 14 students agree with question No.10, and 16 students agree with question No. 12. After the experiment, the number increased to 26 and 25. This means students still have

problems about pay attention to the essay structure and transitional words while writing.

From this result shown in "Table II", it shows that the autonomous mode of English writing based on Jvku AES system is worked for students' English writing metacognitive strategies of selective attention.

TABLE III.　　RESULTS OF QUESTIONNAIRES BEFORE AND AFTER THE EXPERIMENT (QUESTION 13-18)

Questions	Strongly disagree(B/A)	Disagree (B/A)	Neither disagree nor agree(B/A)	Agree (B/A)	Strongly agree(B/A)
Question 13	9.8%/7.8% 5/4	17.6%/2% 9/1	33.3%/31.4% 17/16	31.4%/33.3% 16/17	7.8%/25.5% 4/13
Question 14	17.6%/13.7% 9/7	23.5%/25.5% 12/13	39.2%/25.5% 20/13	13.7%/19.6% 7/10	5.9%/15.7% 3/8
Question 15	9.8%/5.9% 5/3	25.5%/13.7% 13/7	39.2%/39.2% 20/20	19.6%/23.5% 10/12	5.9%/17.6% 3/9
Question 16	5.9%/3.9% 3/2	13.7%/5.9% 7/3	43.1%/35.3% 22/18	25.5%/31.4% 13/16	11.8%/23.5% 6/12
Question 17	11.8%/5.9% 6/3	11.8%/3.9% 6/2	21.6%/23.5% 11/12	39.2%/29.4% 20/15	15.7%/37.3% 8/19
Question 18	9.8%/5.9% 5/3	9.8%/9.8% 5/5	29.4%/25.5% 15/13	23.5%/35.3% 12/18	27.5%/23.5% 14/12

Questions 13-18 are about their English writing metacognitive strategies of self-monitoring. The results are shown in "Table III". Question 13 is "I will check whether the content is around the topic in the process of writing."30 students agree that they will do the check while writing which means the proportion is 58.8% after the experiment (It had raised 19.6%). There are only 5 students disagree with it. Question 14 is "I will check whether there is a topic sentence in each paragraph." and question 15 is "I will check whether the content is written around the topic sentence in the process of writing." For these two questions, students' opinions are similar. 18 students strongly agree with question14 and 21 students agree with question 15 after the experiment. The whole support proportion is 35.3% and 41.1%.

Question 16 is "I will adjust the vocabulary and phrases in the process of writing in time." and question 18 is "I will

adjust my writing speed according to the time of writing." Both of these questions have nearly the same percentage. 54.9% of the students believe they will adjust the vocabulary while writing and 58.8% of them agree they can adjust their writing speed after the experiment, which both have huge improvement compared with before.

Question 17 is "I will check the punctuation in the writing process as well as capital and lowercase letters is correct. "Nineteen students strongly agree with it and 15 students agree with it. Thus, over half of the students express that they will check the punctuation and capital letters while writing. From this result, it shows that students improved their English writing metacognitive strategies of self-monitoring after the English writing training based on Jvku AES system.

TABLE IV.　　RESULTS OF QUESTIONNAIRES BEFORE AND AFTER THE EXPERIMENT (QUESTION 19-24)

Questions	Strongly disagree(B/A)	Disagree (B/A)	Neither disagree nor agree(B/A)	Agree (B/A)	Strongly agree(B/A)
Question 19	13.7%/15.7% 7/8	7.8%/27.5% 4/14	49%/25.5% 25/13	13.7%/13.7% 7/7	15.7%/17.6% 8/9
Question 20	19.6%/13.7% 10/7	19.6%/33.3% 10/17	35.3%/31.4% 18/16	15.7%/11.8% 8/6	9.8%/9.8% 5/5
Question 21	19.6%/7.8% 10/4	35.3%/27.5% 18/14	23.5%/45.1% 12/23	13.7%/9.8% 7/5	7.8%/9.8% 4/5
Question 22	17.6%/13.7% 9/7	19.6%/21.6% 10/11	39.2%/33.3% 20/17	19.6%/21.6% 10/11	3.9%/9.8% 2/5
Question 23	27.5%/23.5% 14/12	27.5%/21.6% 14/11	31.4%/29.4% 16/15	9.8%/19.6% 5/10	3.9%/5.9% 2/3
Question 24	23.5%/17.6% 12/9	23.5%/19.6% 12/10	35.3%/21.6/5 18/11	9.8%/33.3% 5/17	7.8%/7.8% 4/4

Questions 19-24 are about their English writing metacognitive strategies of self-evaluation. "Table IV"

Question 19 is "I will evaluate the content of what I wrote after the writing. "Fifteen students agree that they will evaluate the essay after writing and the support proportion is 29.4% before the experiment. And after the experiment, the proportion has got a small uplift of 1.9%.

Question 20 is "I will evaluate the structure of what I wrote after the writing." and question 21 is "I will conclude at the end of the writing whether the writing method I used is helpful." For these two questions, they have similar results about the percentage change of agreement. No change of the strongly agree for question No. 20 and slightly increase for question No. 21, but they both have a slight decrease of agreement.

Question 22 is "I would like to know whether my essay have reached the goal or the requirement after writing. "Twelve students agree with this question before the experiment and the proportion is 23.5%. Then the number rise to 16 after the experiment.

Question 23 is "I will evaluate what kind of harvest I got after writing." Two students strongly agree with it and 5 students agree with it before the experiment and the number rise to 13 after experiment. Thus, quarter of the students

express that they would make a summary about what they've got after writing.

Question 24 is "I will find out my own shortcomings after writing and figure out ways to improve." There is no difference of the results of strongly agree with it after the experiment but a triple improvement of the number which agree with it. So 21 students agree that they will find out their shortcomings and work on it after writing, the proportion is 41.1%. From this result, it shows that students improved their English writing metacognitive strategies of self-evaluation after the English writing training based on Jvku AES system.

To summarize, from the table the average percentage of agree (include strongly agree) is 30.0% before the experiment, and after the experiment the total proportion of agree is 46.0%. It means that most students made progress on their English writing metacognitive strategy after the experiment. During the whole process, they are willing to take part in it.

B. The Descriptive Results of Writing Tests

1) Paired sample test of every writing test: The Pre-test (first test) was taken on September 8th and 51 students uploaded their compositions. The second test was taken on September 20th and 51 students uploaded their compositions.

TABLE V.   PAIRED SAMPLE TEST OF PRE-TEST AND SECOND TEST

	N	Mean	Std. Deviation	T	P
First	51	80.500	5.8609	0.295	0.769
Second	51	80.1667	5.9445		

After the paired sample test of pre-test and second test, it can be seen from the "Table V" that p=0.769, p >0.05. It means that there is no big difference of students' grades between the first test and the second test.

The third test was taken on October 2nd and 51 students uploaded their compositions.

TABLE VI.   PAIRED SAMPLE TEST OF SECOND TEST AND THIRD TEST

	N	Mean	Std. Deviation	T	P
Second	51	80.1667	5.94447	2.393	0.020
Third	51	81.7549	4.63290		

From the "Table VI", it can be seen that p=0.020, p < 0.05, and students' mean grade has improved from 80.1667 to 81.7549. So it means that students have made some improvement in third writing task.

The fourth test was taken on October 14th and 51 students uploaded their compositions.

TABLE VII.   PAIRED SAMPLE TEST OF THIRD TEST AND FOURTH TEST

	N	Mean	Std. Deviation	T	P
Third	51	81.7549	4.63290	0.421	0.676
Fourth	51	82.0490	5.16939		

After the paired sample test of third test and fourth test, it can be seen from the "Table VII" that p=0.676, p >0.05. It means that there is no big difference of students' grades between the third test and the fourth test.

The fifth test was taken on October 26th and 51 students uploaded their compositions.

TABLE VIII.   PAIRED SAMPLE TEST OF FOURTH TEST AND FIFTH TEST

	N	Mean	Std. Deviation	t	P
Fourth	51	82.0490	5.16939	2.913	0.005
Fifth	51	84.2415	2.11748		

From the "Table VIII", it can be seen that p=0.005, p < 0.05, and students' mean grade has improved from 82.049 to 84.2451. So it means that students have made some progress in fifth writing task.

The sixth test was taken on November 10th and 51 students uploaded their compositions.

TABLE IX.   PAIRED SAMPLE TEST OF FIFTH TEST AND SIXTH TEST

	N	Mean	Std. Deviation	t	P
Fifth	51	84.2415	2.11748	1.481	0.145
Sixth	51	83.1863	5.1778		

After the paired sample test of fifth test and sixth test, it can be seen from the "Table IX" that p=0.145, p >0.05. It means that there is no big difference of students' grades between the fifth test and the sixth test.

The seventh test was taken on November 22nd and 51 students uploaded their compositions.

TABLE X.   PAIRED SAMPLE TEST OF SIXTH TEST AND SEVENTH TEST

	N	Mean	Std. Deviation	t	P
Sixth	51	83.1863	5.1778	3.725	0.000
Seventh	51	86.3039	2.74605		

From the "Table X", it can be seen that p=0.000, p < 0.05 and students' mean grade has improved from 83.1863 to 86.3039. So it means that students have made some progress in seventh writing task.

The post-test was taken on December 15th and 51 students uploaded their compositions.

TABLE XI.   PAIRED SAMPLE TEST OF SEVENTH TEST AND EIGHTH TEST

	N	Mean	Std. Deviation	t	P
Seventh	51	86.3039	2.74605	2.566	0.013
Eighth	51	87.598	3.18123		

From the "Table XI", it can be seen that p=0.000, p < 0.05, and students' mean grade has improved from 86.3039 to 87.598. So it means that students have made some progress in post-test.

2) Paired sample test of pre-test and post-test:

TABLE XII.   PAIRED SAMPLE TEST OF PRE-TEST AND POST-TEST

	N	Mean	Std. Deviation	t	P
Pre-test	51	80.5000	5.86089	7.414	0.000
Post-test	51	87.5980	3.18123		

From the "Table XII", it shows that after the experiment, p=0.000, p < 0.05 and students' mean grade has improved from 80.5000 to 87.5980. So it means that students in the experiment class have made a big improvement in English writing.

To sum up, from "Table I" to "Table VIII", it can be seen that students improved their writing grades after the experiment. After taking the experiment, the mean grade of the class has improved from 80.5000 to 87.5980. The p value is 0.000 and it is less than 0.05. Thus, students in the class have made progress after a semester's study, so the Jvku AES system has worked and this autonomous mode of English writing is effective in improving students' English writing level.

V.   CONCLUSION

Through the analysis of two questionnaires, eight writing tests and interviews towards students, the conclusion is as follows.

Firstly, there is a significant improvement in senior high school students' English writing metacognitive strategy after the experiment. The noticeable improvement of students' writing metacognitive strategies can be seen in the process of the research.

Secondly, the second research question addressed by comparing students' English writing training scores for eight times and analyzing them in SPSS. It's not hard to see that students' English writing grades rise with the improvement of students' writing metacognitive strategy. With high level of writing metacognitive strategy, students pay more attention to their writing process. Jvku AES system can provide feedback immediately to help students to reduce Chinglish mistakes, grammar mistakes, spelling mistakes and other technical errors, which mainly focus on enhancing their vocabulary and grammar levels. However, because lacking of evaluation on essay's abstract factors like logic thinking and discourse structure, the composition contents, discourse structure are still difficult points for their English writing.

Thirdly, teacher still plays an indispensible role in English teaching. Although Jvku AES system can give comments about essay's quantized factors like language points and form errors, the abstract factor like contents still need teachers' feedback. The most importantly, Jvku AES system doesn't provide the positive feedback to students which also need teachers to supply.

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