Scalable Computing: Practice and Experience, ISSN 1895-1767, http://www.scpe.org
© 2024 SCPE. Volume 25, Issues 2, pp. 987–996, DOI 10.12694/scpe.v25i2.2617

THE EFFECTS OF INTEGRATED FEEDBACK BASED ON AWE ON ENGLISH WRITTING OF CHINESE EFL LEARNERS

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Abstract. Through a two-semester experiment on the English writing of 64 Chinese EFL learners, this study examines the effects of three types web-based feedback (automatic feedback (AF), automatic feedback with teacher feedback (TF), automatic feedback with peer feedback (PF)) based on Pigai website. The results show that all the three modes of feedback can promote the writing of the English as Foreign Language (EFL) learners with different English proficiency ((high level: F = 2.672, P = .132; low level: F = .388, P = .766). The results also reveal that there is a significant difference in the high-level group between the automatic feedback + peer feedback group and the automatic feedback group (I - J = - 6.636, P = .000) as well as between the automatic feedback + teacher feedback group and the automatic feedback group (I - J = - 6.220, P = .001; I - J = - 5. 100, P =. 001), which indicate that automatic feedback + manual feedback (PF+TF) can promote the improvement of high-level learners' English writing more than single AF. In the low-level group, between the AF + PF group and the AF group (I - J = -1.221, P = .925) and between the AF +TF group and the AF + PF group (I - J = 6.227, P =. 097). There is no significant difference, but there is a significant difference between the AF group and the AF + TF group (I - J = - 5.122, P =. 032), indicating that AF + TF is of great help in improving the English writing of low-level English learners.

Key words: integrated feedback; automated writing evaluation (AWE); English writing; Pigai website

1. Introduction. Since the 1990s, feedback has been an important research topic in the field of second language acquisition, with the effectiveness of writing feedback being an important topic in second language writing feedback research [41, 42, 13, 24, 30]. In existing empirical studies, comparing the effectiveness of different feedback is a hot topic in writing feedback research [6, 7]. As Huisman et al. (2019) found, there was no significant difference in the impact of peer feedback (PF) and teacher feedback (TF) on students' writing performance. Thirakunkovit & Chamcharatsri [40] found that TF has a greater effect than PF. Double et al. (2020) [12] found that PF has a greater effect than TF. As to the research in China, Xing and Luo (2014) [54] found that PF and TF have a similar impact on students' overall writing level, and the effect of PF+TF is better than that of TF alone. Li and Sun (2019) [27] found that TF and mixed feedback have a significant effect, while PF has a relatively small effect. It can be seen that the effectiveness of feedback from different sources in writing is still controversial and requires further research in the EFL teaching context in China. Furthermore, in current English writing teaching in China, there are a lot of work for teachers to correct their learners' compositions. Although timely and effective TF is helpful to improve their learners' writing competence, it is often time-consuming and laborious. In order to solve this problem, Automated writing evaluation (AWE) system was born as needed. AWE can provide writing feedback on a large scale and in time, and to some extent, it can relieve the pressure of teachers' correction, so it has been rapidly popularized in the English as Foreign Language (EFL) teaching in China these years. Nowadays, some famous AWE systems including Pigai website, Criterion, MyAccess in China provide not only the total score and sub-score of the compositions, but personalized feedback from macro (such as essay center, structure, content organization, etc.) to micro (such as grammar, spelling, idiomatic usage, etc.) feedback. An in-depth comparison of the effects of automated feedback (AF), TF and PF on the EFL learners in China through empirical research is helpful for the active selection of the EFL writing teaching modes and methods in both China and other countries.

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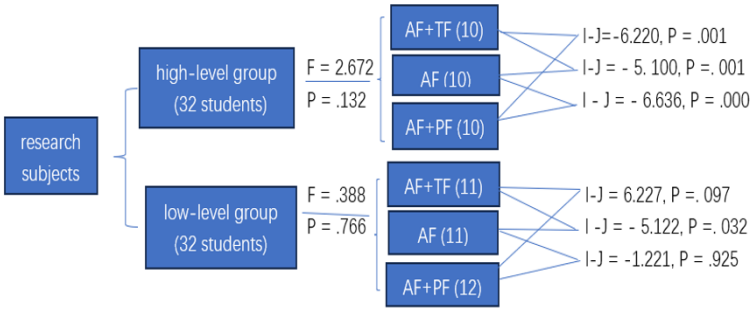

Fig. 1.1: Research Subjects

2. Literature review. Writing feedback is undoubtedly an important part of writing in both second language teaching and foreign language teaching around the world. How to evaluate the impact of feedback on language capacity in English as second language (ESL) and EFL writing, the past research has mainly focused on the impact of corrective feedback on writing accuracy or using CAF (Complexity, Accuracy and Fluency) as a framework to "panoramically" measure and describe the accuracy, complexity and fluency of language in learners' writing [3, 16, 29, 35, 45, 53]. Most of the research results found that writing feedback can promote learners to discover and revise problems, and get inspiration from feedback. It is an important tool for gradually developing self-expression capacity and a way for readers to respond and evaluate authors [47]. Feedback generally contains two basic elements: evaluation and correction. Evaluation refers to readers' overall and general comments or ratings on the author's article; revision refers to readers providing detailed introductions, explanations and guidance to the author, aiming to help the author identify and correct deficiencies [36]. The types of feedback in English writing can be distinguished from different perspectives: according to the form of feedback, it can be divided into oral feedback and written feedback; according to the source of feedback, it can be divided into teacher feedback, peer feedback and automatic feedback from online systems.

Writing feedback is an important part of the writing process. Appropriate feedback can help learners understand the strengths and weaknesses of their own writing and play a positive role in improving learners' English writing [5]. In recent years, many researchers have paid more and more attention to the influence of writing feedback on improving English writing level, and different forms of feedback models have also been used in English writing teaching.

In tertiary English writing teaching, due to the limited time spent on writing training in the classroom, it is necessary to find a feedback method that allows learners to regularly practice English writing outside the classroom and receive immediate and effective feedback [2]. With the use of computer feedback and network feedback in English writing teaching, automatic writing evaluation system came into being. The automated writing evaluation (AWE) system based on computer technology has higher reliability and validity than manual evaluation [25, 50], and with other advantages like the immediacy of feedback (Attali 2004; Dikli 2006), attracting and promoting multiple revisions by learners [49], being able to be used for both formative and summative evaluations [39], so it has become a category that cannot be ignored in writing feedback research.

There are some representative writing automatic evaluation systems nowadays as Criterion, MyAccess, Writing Roadmap (WRM), and the most widely used composition automatic evaluation system in China is Juku Pigai Website (hereinafter referred to as Pigai website) developed by Beijing Ciwang (word network) Technology Co., Ltd. The research on the application of automatic evaluation system (AWE) in writing classrooms shows that the system can meet the needs of learners' personalized evaluation and feedback, and help learners to correct language errors [34], and significantly improve composition scores and improve composition

quality [1, 17]. The use of automatic evaluation systems allows learners to continuously participate in the "feedback-practice-feedback" writing cycle, thereby continuously improving their writing skills [26].

Scholars hold different opinions on whether AWE can promote the development of learners' written language. Some related studies have shown that the automatic scoring system can provide immediate and effective feedback to learners' composition, so that the learners can make repeated revisions, improve their autonomous learning capacity, and reduce the workload of teachers [4, 38]. Some scholars have carried out practice and research on automatic composition evaluation system [49], and found that automatic feedback has a positive effect on the development of learners' writing capacity because it can promote learners to revise multiple times, which proves that it can help improve learners' English writing level used Criterion as a tool to provide automatic feedback on writing [46, 57], and found that AWE was beneficial to the improvement of learners' language accuracy.

Nevertheless, it is impossible for machines to completely replace people, and the automatic review system has certain shortcomings. Studies proposed that the automatic revision of writings by machines deviates from the essence of writing itself [8, 33], which is a complex and highly interactive interpersonal communication behavior, and may mislead learners to focus only on syntactic form, while ignoring the development of content and ideas. On the one hand, "it can only judge the level from the language, not the content from the semantics, but it can't identify the content errors of the composition, and some language errors can't be identified" [22]. On the other hand, there are many studies on feedback from automated correction systems that are inconsistent. There is research studied the role of teachers and peers in writing evaluation, and the results showed that the learners who received teacher and peer feedback performed best [43]; the learners who received teacher feedback performed better than those who received peer feedback, while the learners who received peer feedback performed the worst. However, a study came to the opposite conclusion: the writing performance of the learners in the peer evaluation group has made greater progress, which is significantly better than that in the teacher feedback group [9]. With the deepening of the research, the researchers found that although the automatic evaluation system provides timely and fast feedback, it is inferior to the teacher feedback in terms of the quantity and accuracy of misidentification [10]. The system has played a positive role in correcting learners' language errors, but the feedback information in terms of discourse content and coherence is vague, abstract, and programmed, and it cannot make specific revision suggestions for individualized problems like teachers do [7, 57].

At present, the AWE system represented by Pigai website has gradually been widely used in foreign language teaching in colleges and universities in China, especially in EFL teaching. However, there are few studies on the impact of automatic writing feedback on learners' written language. A study used the Writing Roadmap 2.0 composition automatic evaluation tool developed in the United States to evaluate the impact of AWE on the development of Chinese college learners' English writing capacity from 7 indicators of English composition [21], and made a positive conclusion to AWE. While [56], who also used Pigai website as a tool to study learners' self-learning behavior in online writing, came to different conclusions. The former believes that the self-writing teaching mode based on Pigai website can effectively improve the overall level of learners' English writing, but the latter finds that the number of learners' self-correction is limited, the quality is not high, and the effect of composition optimization is not quite obvious.

In view of this, it has become one of the hot research issues in academia as how to combine the AWE system with teacher feedback to build a multiple feedback mechanism, to make up for the shortcomings of the AWE system by taking advantage of PF and TF, so as to provide learners with more comprehensive, objective and accurate feedback. A former study discussed the multi-dimensional feedback writing teaching pilot model based on the WRM automatic evaluation system [39]. The results show that this model can promote the development of learners' writing capacity and has a positive impact on the teaching process. This research mainly focuses on the influence of multi-dimensional feedback teaching mode on learners' writing capacity, but does not specifically discuss the influence of multi-feedback on learners' writing modification. Moreover, the research object is high school learners, and the application and effect of other sample objects also need to be further tested. Huang's works discussed the influence of multiple feedbacks such as feedback from Pigai website, peer feedback and teacher feedback on learners' writing revision and writing behavior, and found that integrated feedback can improve learners' writing behavior and motivate learners' subjectivity to improve text quality [18, 19]. These two studies have conducted useful exploration and research on the influence of multiple

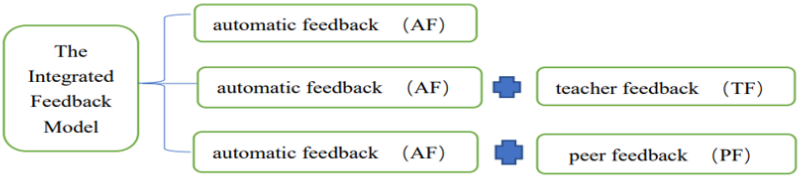

Fig. 3.1: The model of variables

feedback on the type and function of learners' writing revision and text quality, but did not conduct specific research on the impact of multiple feedback on the effect of learners' writing modification. Other studies have shown that, compared with the feedback provided by the teacher, the feedback provided by the computer is more effective in promoting language acquisition [47]. As a writing teaching and evaluation method, multiple feedback needs more theoretical and practical demonstrations, and more extensive sample experiments are needed to test its effects. Based on this, this study uses the feedback function of the automatic evaluation system of Pigai website, combines teacher feedback and student feedback, as well as the impact on the number, type and effect of revisions in learners' English writing, with a view to further enriching writing through this research. The content and scope of feedback research provide empirical evidence and a new feedback operation mode for English writing teaching.

3. Research design.

3.1. Research questions. This study attempts to answer the following questions:

1. Do the three feedback modes of AF, AF + TF and AF + PF have different effects on the EFL learners' English writing in China?
2. Is it related to the learners' English level (higher English proficiency and lower English proficiency)?

3.2. Research method. This study adopts a between-group design with a total of two independent variables: feedback mode (AF, AF + TF, AF + PF) and the subjects' English level (high and low level). The dependent variable is the final exam essay scores in semester 1 and semester 2.

3.3. Research subjects. The subjects of the study were two classes with 64 sophomore learners majoring in English at a comprehensive university in northern China, with 32 learners in each class, including 15 boys and 49 girls, with an average age of 20 years old. Before the experiment, the teacher assigned an English composition titled "Why Do You Learn English" to the learners in the two classes, which was required to be completed within 30 minutes and the number of words should not be less than 200 words. The composition is graded by two teachers at the same time. The grading standard is that each sub-item of length, structure, content and language expression accounts for 25 points, and the full score is 100 points. The average scores of the two classes were 73.60 (Class 1) and 68.63 (Class 2), and the scores of the two classes were significantly different ($t = -7.332$, $P = .000$). Therefore, the author set the learners of Class 1 (32 people) as the high-level group, and the learners of Class 2 (32 people) as the low-level group, and then randomly divided the learners of the high-level and low-level groups into six groups, respectively. Accept three different forms of feedback, namely automatic feedback (10 high level learners, 11 low level learners), automatic feedback + teacher feedback (10 high level learners, 11 low level learners), automatic feedback + peer feedback (10 high level learners, low level 12 learners).

3.4. Selection of AWE system. At present, there are many mature AWE systems in the world, but some are not designed for learners of second language acquisition or EFL learning, and it is difficult to provide feedback, textual and syntactic suggestions in line with the characteristics of the EFL learners in China. Therefore, this study wishes to adopts a self-developed AWE system by Chinese, which would be convenient for

its promotion in English teaching and learning in China, and it can also accumulate more empirical research experiences for the development of AWE system for the EFL learners in the national conditions of China.

After comparing the functions and convenience of several major AWE systems in China, we chose Pigai website, which is an online service system for automatic correction of English writings based on corpus and cloud computing. The analysis results of learners' writing can be generated instantly based on its corpus [22]. Like other AWE systems, Pigai website can provide individualized feedback on the total score, overall evaluation, vocabulary, grammar, style and other individual items of the writing. At the same time, it has its own innovations, such as the combination of automatic review of the support system and manual review by teachers, providing excellent writing sharing and some other functions.

3.5. Research process. In order to improve the evaluation capacity of learners' English writing and ensure that the peer feedback is really effective, the learners in the automatic feedback + peer feedback group were given peer feedback training before the experiment. It mainly trains learners how to give feedback on writing content to make up for the lack of feedback from the automatic review system. The feedback of the automatic rating system is mainly for the language form of the writing, including grammar, sentence pattern, vocabulary, punctuation, etc., and cannot give sufficient feedback on the structure, logic and coherence of the content. The content is the most important aspect to measure the quality of writing [51]. Only by paying full attention to the content, that is, paying attention to those elements with "substantiality" and "overall", can the writing capacity be improved [55].

In the experimental stage, the learners in two classes have to complete 10 writings in two semesters, 5 in each semester, and one composition every three weeks. The genre of these writing involves culture, life, morality, environmental protection, tourism and other hot social issues.

The teacher arranges the writing task on Pigai website and tells the composition number to the learners. After the learners in the automatic feedback group complete the composition, Pigai website will automatically correct it, and then the learners will modify it according to the automatic feedback until they are satisfied. After the learners in the AF + TF group complete the composition, they will also get the automatic feedback in Pigai website, and then the learners will modify it themselves until they are satisfied, and then the teacher will use the quick comment function of Pigai website to give feedback on the learners' composition, and then the learners will revise it again themselves; After the learners in the automatic feedback + peer feedback group complete the composition, and firstly the learners will revise the composition themselves according to the feedback by Pigai website until they are satisfied. Up to now, the teacher will randomly arrange mutual correction among learners on Pigai website, and then the learners will make corrections again themselves.

3.6. Test score. The research measurement objects of this study include: a pre-writing test and two post-writing tests (post-test 1 and post-test 2), in which the two post-tests are the final exam composition scores of the first and second semesters respectively.

Two teachers with extensive teaching experience will grade the learners' writing in the pre-test and the two post-tests. The scoring standard is that each sub-item of length, structure, content and language expression accounts for 25 points, and the full score is 100 points. When two teachers have a large difference in the scores of the same composition, the third teacher will give the score, and the average of the two similar scores will be taken at the end. If the difference is not large, the final score will be the average of the scores given by the two teachers. The researcher counted the reliability between the raters and found that the values were between 0.81 and 0.91, indicating that there was a high degree of consistency among the raters.

4. Data analysis. Table 4.1 shows the average scores and standard deviations of the writing scores of the high- and low-level groups under the three feedback methods of pre-test, post-test 1, and post-test 2.

The data in Table 4.1 shows that in the low-level group, the automatic feedback + teacher feedback group has the highest average scores in post-test 1 and post-test 2; in the high-level group, the automatic feedback + teacher feedback group and the automatic feedback + peer feedback group indicating that different feedback methods have different effects on learners' writing.

To further examine whether the three feedback methods have different effects on learners' writing, one-way ANOVA on the writing scores of post-test 1 and post-test 2 was performed respectively (see Table 4.2). The results showed that in post-test 1, there was no significant difference in the effects of the three feedback methods

Table 4.1: The writing scores of the high level and low level groups under the three feedback in the pre-test, post-test 1, and post-test 2 writing

Subject	Group	Number of leaners	Pre-test		Post-test 1		Post-test 2	
			Average score	Standard deviation	Average score	Standard deviation	Average score	Standard deviation
Low level group	AF	11	75.53	3.54	77.21	4.55	79.52	4.82
	AF+TF	11	74.16	4.83	78.44	5.34	81.22	4.75
	AF+PF	12	76.87	4.41	78.63	5.46	81.74	5.58
	Total	34	75.52	4.26	78.09	5.12	80.82	5.05
High level group	AF	10	87.26	4.65	88.34	3.32	90.23	3.11
	AF+TF	10	88.38	4.86	89.77	3.34	90.73	2.67
	AF+PF	10	90.12	4.23	91.01	3.51	92.22	2.56
	Total	30	88.57	4.58	89.71	3.39	91.06	2.77

AF: Automated Feedback; TF: Teacher Feedback; PF: Peer Feedback

Table 4.2: One-way ANOVA results for post-test 1 and post-test 2

		Sum of squares		Degree of freedom		Mean square		F value		P value	
		High	Low	High	Low	High	Low	High	Low	High	Low
Post-test 1	Between groups	63.522	22.645	2	2	31.266	11.262	2.672	.388	.131	.766
	Within group	322.156	946.452	36	43	13.663	31.561				
	Total	385.678	969.097	38	45						
Post-test 2	Between groups	266.672	298.422	2	2	120.335	143.366	17.762	6.425	.000	.022
	Within group	233.362	928.322	36	43	8.336	32.163				
	Total	500.034	1226.744	38	45						

$^{*}P < .05$ *means there is a significant difference*

on the writing of high-level and low-level learners (high level: F = 2.672, P = .132; low level: F = .388, P = .766); and in the post-test 2, the effects of the three feedback methods on the writing of high-level and low-level learners were significantly different (high level: F = 17.762, P = .000; low level: F = 6.425, P = .022), indicating that different feedback methods have different effects on learners' writing.

We performed a post-hoc test of the effect of the three types of feedback on writing in post-test 2 with the Schéffe test (see Table 4.3). The results showed that, there is a significant difference in the high-level group between the automatic feedback + peer feedback group and the automatic feedback group (I - J = - 6.636, P = .000) as well as between the automatic feedback + teacher feedback group and the automatic feedback group (I - J = - 6.220, P = .001; I - J = - 5. 100, P =. 001), which indicate that automatic feedback + manual feedback (PF+TF) can promote the improvement of high-level learners' English writing more than single automatic feedback. In the low-level group, between the automatic feedback + peer feedback group and the automatic feedback group (I - J = -1.221, P = .925) and between the automatic feedback + teacher feedback group and the automatic feedback + peer feedback group (I - J = 6.227, P =. 097) There is no significant difference, but there is a significant difference between the automatic feedback group and the automatic feedback + teacher feedback group (I - J = - 5.122, P =. 032), indicating that AF + TF is of great help in improving the English writing of low-level English learners.

In order to verify whether the three types of feedback have an impact on the writing effect, the author conducted a paired sample t-test on the English writing scores in the pre-test, post-test 1 and post-test 2. It can be seen from Table 4.4 that the last test of the three types of feedback is significantly different from the

Table 4.3: The influence of three different feedback methods on the English writing capacity of the high- and low-level groups: results of Scheffé test analysis

Subject	dependent variable	independent variable		Mean difference (I-J)	P value
		(I) Feedback	(J) Feedback		
Low level group	Post-test 2	AF	AF+TF	-5.122(*)	.032
		AF	AF+PF	-1.221	.925
		AF+TF	AF+PF	6.227	.097
High level group	Post-test 2	AF	AF+TF	-6.220(*)	.001
		AF	AF+PF	-6.636(*)	.000
		AF+TF	AF+PF	-.766	.935

AF: Automated Feedback; TF: Teacher Feedback; PF: Peer Feedback
$^{*}P < .05$ *means there is a significant difference*

Table 4.4: Paired sample t-test between pre-test, post-test 1, post-test 2

Subject	Group	Test pairing	t-value	p-value
Low level group	AF	pretest-posttest 1	-3.954	.002
		pretest-posttest 2	-6.883	.000
		Posttest 1-posttest 2	-9.788	.000
	AF+TF	pretest-posttest 1	-6.667	.000
		pretest-posttest 2	-12.465	.000
		Posttest 1-posttest 2	-7.232	.000
	AF+PF	pretest-posttest 1	-6.645	.000
		pretest-posttest 2	-10.112	.000
		Posttest 1-posttest 2	-8.267	.000
High level group	AF	pretest-posttest 1	-7.757	.001
		pretest-posttest 2	-3.326	.000
		Posttest 1-posttest 2	-6.563	.017
	AF+TF	pretest-posttest 1	-6.672	.015
		pretest-posttest 2	-9.553	.000
		Posttest 1-posttest 2	-4.425	.012
	AF+PF	pretest-posttest 1	-5.344	.032
		pretest-posttest 2	-11.332	.000
		Posttest 1-posttest 2	-6.733	.004

previous test, indicating that the three types of feedback can promote the English writing level of both high- and low-level learners.

5. Results and discussion.

5.1. Results. The experimental results show that, in post-test 2, there are significant differences in the effects of the three modes of feedback on the English writing of high-level learners and low-level learners. For high-level learners, there are significant differences between AF + PF group and the AF group, as well as between AF + TF group and AF group, indicating that AF + manual feedback mode is better than single AF, and manual feedback makes up for the lack of AF. However, there is no significant difference between AF + PF group and AF + TF group, which may be because the learners in the high-level group have stronger evaluation capacity, although it may not be as good as TF, it can also prompt peers to improve their English writing level. At the same time, learners can also find problems in their own writing while evaluating other learners' writing, so as to improve their own writing. Rollinson (2005) believes that learners can learn to review and revise their

own articles through peer review (Rollinson 2005). Both Tsui and Lundstroms found that reviewing peers' compositions was more beneficial to improving writing skills than receiving PF (Lundstroms and Baker 2009; Tsui and Ng 2000), because reviewers could learn some writing skills from others' compositions and apply them to their own writing to improve writing skills.

For low-level subjects, there was no significant difference between AF + PF group and AF group. This may be because the learners with a lower level cannot find problems with each other, and even if they find problems with the help of their peers, they are not able to put forward specific suggestions for revision, so these learners basically fail to meet the requirements of PF. In addition, it may also be that learners lack of confidence in peers, believing that they cannot be a qualified reviewer, and therefore be skeptical of PF (Cai 2011; Muncie 2000; Tsui and Ng 2000), and thus slower to improve writing skills (Gong 2007; Wang 2004). There is a significant difference between AF group and AF + TF group, indicating that TF is of great help to the improvement of English writing skills of the learners with lower levels. However, in post-test 1, there was no significant difference in the effects of the three types of feedback on the English writing of the high-level and the low-level learners, probably because the experiment time was not long enough to find the difference in the effect between different feedback modes.

5.2. Discussion. This study also found that there were significant differences between the last test of the three modes of feedback and the previous test, and the three modes of feedback had a positive effect on the improvement of English writing capacity of both high-level and low-level learners in China. The automatic evaluation system can greatly reduce the workload of teachers, and it can be used in a reasonable combination with teacher feedback to give full play to its potential. It can reduce the burden on teachers, promote learners' writing practice, and improve their English writing faster. In fact, compared with face-to-face feedback, online writing feedback has less psychological pressure and less anxiety, so learners are more willing to put forward real ideas and opinions (Guardado et al. 2007; Jiang 2005).

This paper conducted a specific study on the impact of diverse feedback on the effectiveness of student essay revision, while Huang and Zhang (2014) and Huang and He (2018) only explored the impact of diverse feedback on the types and functions of student essay revision, as well as text quality. Although some study has shown that feedback provided through computers is more effective in promoting language acquisition compared to feedback provided by teachers (Wang Lina et al., 2018: 44), and this study combines sample experiments to test its effectiveness, providing theoretical and practical evidence for multiple feedback. Furthermore, this study also provides empirical evidence for further enriching the content and scope of writing feedback study by using the method of natural classroom data collection, which also provides a new feedback operation mode for English writing teaching and evaluation methods.

6. Conclusions. Multiple feedback based on automatic evaluation systems emphasizes the supervision and regulation of students' writing process. By adopting a feedback model that combines AF, TF, and PF, the learning space can be expanded, and various feedback can be organically combined and mutually supplemented, thereby stimulating students' initiative and enthusiasm for writing revision. Moreover, manual-machine collaborative review can incorporate interpersonal interaction into writing feedback, overcoming the limitation of automatic writing evaluation systems that only focus on cognitive processing, thus effectively achieving the purpose of writing communication in both form and meaning.

This study still has certain limitations: First, the subjects are just the EFL learners in a local university in China, and the number of research subjects is small. The high-level and low-level groups in the experiment are only relative, and further study on the effects of the EFL learners' English writing feedback in China with other levels of subjects are expecting. Second, this study explores the overall quality of the EFL learners' English writing, but it does not explore specific dimensions of English writing, such as accuracy, fluency, language diversity, and syntactic complexity. More collaborating study on these dimensions are expected in the future.

Acknowledgements. This article is the periodical research of the project 'The influencing factors and effective paths of blended learning development in universities from the ecological perspective' (Code: J18RA149) supported by the Shandong Education Department.

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Edited by: Mudasir Mohd
Special issue on: Scalable Computing in Online and Blended Learning Environments: Challenges and Solutions
Received: Sep 19, 2023
Accepted: Nov 17, 2023