Improving Rural School Teaching Quality through Blended Synchronous Classroom: A Value-Added Assessment Study

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Abstract**:** *Students' academic performance is an important means to evaluate the quality of teaching and learning. Value-added assessment of data of their performance can reveal the increment of students' development. As so, this study used a simple growth percentile value-added assessment model to analyze the effects of regular blended synchronous English classroom to third-grade in 29 rural elementary schools in G Province, and used a standardized score model to verify its validity. The results show that: (1) Nearly 80% of the schools fall into the categories of high and normal growth, indicating that blended synchronous classrooms have a positive effect on promoting students' academic performance. (2) Differences in students' learning progress across schools are closely associated with variations in the motivation and participation of schools, teachers, and students. The findings of this study for the exploration of value-added assessment and the effectiveness of blended synchronous classroom teaching provide important insights.*

Keywords: rural blended synchronous classroom, Simple Growth Percentile Model, Standardized Score Model, value-added assessment, teaching effect

1. Introduction

In developing and emerging economies, the educational gap between urban and rural areas tends to be more pronounce (Amini & Nivorozhkin, 2015). As Philip Coombs observed, "In developing countries' rural areas, education quality is low, with underqualified teachers and many poor children who need good teachers most but get them least." .(Coombs, 1985). In the context of China, the largest developing country, there exists a educational disparity between urban and rural areas (Yang et al., 2019).

With the empowerment of computer and network technology, blended synchronous classroom (BSC) has become an innovative practice paradigm of ICT, offering a viable solution to the issue of educational inequality. For instance, the implementation of cloud-based educational institutions facilitates the provision of high-quality teaching resources to rural areas (Zhang et al., 2018), enabling students to engage remotely with proficient educators and participate in real-time interactions (Carmel et al., 2010).

In the field of educational assessment, value-added assessment (VAA) refers to a longitudinal research design (Tekwe et al., 2004). Taylor (1985) was the first to explicitly propose the VAA method, using the term "value-added" to describe the learning progress and development demonstrated by students during the learning process. It refers to analyzing students' learning process and outcomes over the entire duration of their study or a specific phase, to capture the "increment" of their academic progress or development. This study employs VAA to examine the effectiveness of BSC in teaching and uses the academic test data of third-grade students in regular blended synchronous English classrooms in 29 primary schools in a county in G province, China. We utilize both the simple growth percentile model and the standardized score model, employing a dual-model mutual validation approach, providing a basis for verifying the effectiveness of blended synchronous instruction.

2. Literature Review

2.1. Studies related to value-added assessment

Traditional assessment models often emphasize final outcomes, overlooking the developmental dynamics that unfold during the learning process. In contrast, VAA places greater emphasis on the growth and development of students, teachers, and the continuous optimization of the education system as core considerations. This approach facilitates a transition from a static to a dynamic evaluative framework. Numerous scholars have conducted research based on the value-added assessment approach. Timmermans et al. (2014) conducted a synthesis of seven empirical studies to investigate the variations in value-added indicators through the inclusion of school composition variables. Their findings revealed notable disparities in the strength of the relationship between the Type A model (utilizing student-level covariates) and the Type B school effect model (incorporating both student- and school-level covariates) across different geographical regions. Şen et al. (2020) found that, based on TEOG data from 539 secondary schools in Şanlıurfa, exam averages are insufficient, whereas value-added models provide a more objective measure of school effectiveness. Collectively, these studies enhance the understanding of the theoretical and practical implications of VAA from multiple perspectives and provide research support for the selection of VAA methods in this study to evaluate the effectiveness of teaching within BSC.

2.2. Selection of value-added assessment models

Student Growth Percentile (SGP) developed by Betebenner (2009) and based on quantile regression has been adopted by over 20 U.S. states. Scholars have examined SGP from various perspectives, addressing its foundational principles, calculation methodologies (Betebenner, 2011), error-related issues (McCaffrey et al., 2015), and frameworks for improvement (Monroe et al., 2014). Additionally, preliminary validation of the model's effectiveness for VAA was conducted utilizing actual test data from students (Briggs & Betebenner, 2009; Kurtz, 2018; Taherbhai et al., 2014). Although SGP is based on quantile regression estimation, its computational complexity makes practical implementation challenging. In response to identified limitations in its application, researchers developed a simplified growth percentile, replacing the complex quantile regression method with percentile rank (PR) calculations (Shen, 2022). Therefore, this study employs the simplified growth percentile to conduct a VAA of the teaching effectiveness within rural BSC.

In addition to the use of SGP, standardized score models serve as a tool in VAA due to their ability to transform raw data into a common scale through standardization. Prior et al. (2021) applied Z-score standardization to student attainment, absence, and exclusion data, suggesting that academic-only value-added models inadequately capture overall school performance. The SGP evaluates growth based on the relative position changes of students' scores, while Z-score can transform raw scores into standardized values with a unified dimension, which not only eliminates score differences across subjects or tests but also accurately depicts the relative position of students' scores in the population. This aligns methodologically and mutually validates data with the SGP's logic of assessing growth through relative score position changes.

2.4. Research question

This present study draws on empirical data from Grade 3 English BSC in 29 rural primary schools in Province G, China. A dual-model validation approach is employed to assess the instructional effectiveness of BSC. The research focuses on the following key questions:

RQ1. What is the overall progress in English learning among students across schools?

RQ2. What differences exist in students' English learning progress across schools?

3. Methods

3.1. Participants

The data were collected from 29 primary schools in a county in G Province, where Grade 3 students routinely receive blended synchronous English instruction. These schools are part of the county's total of 84 primary schools. During the 2022 - 2023 academic year, all participating students completed two rounds of standardized English academic achievement assessments, administered citywide by the municipal education bureau. These two sets of test scores were used for VAA. To ensure valid data analysis and interpretation, students with missing scores from either assessment were excluded. Consequently, 5413 student records from 84 schools were included in the final analysis, including 472 students from the 29 schools implementing the blended synchronous English classroom.

3.2. Data processing and analysis

This study employs the simplified growth percentile to analyze sample English scores from two rounds of academic quality assessments, aiming to evaluate students' overall academic progress and institutional developmental characteristics across different schools. Initially, the first test results from 5,413 students across 84 schools were compiled to calculate PR for each student. Subsequently, these students were categorized into "Academic Partner" groups. Using the second test data for all students, PR for each student within each "academic partner" group was calculated to derive the SGP values. Individual student progress in English learning was determined with reference to the "Academic Partner" reference group. These SGP values were then employed to establish the teaching development level for each school. The mSGP within each school was utilized to represent the changes in teaching growth at these levels. Ultimately, the growth levels of students and schools participating in blended synchronous instruction were evaluated based on the established classification criteria. The SGP values were categorized into three growth levels: low growth level (0-34), normal growth level (35-65), and high growth level (66-100). The distribution of students across these categories contributed to each school's value-added score, with higher scores reflecting stronger instructional quality and learning outcomes(see Table 1).

Table 1. *Partial VAA Results of Rural BSC Teaching and Learning Based on the simplified growth percentile*

School	Number of Students	School Value-added Scores (mSGP)	Student Growth Level (SGP)					
			Low Growth Level (0~34)		Normal Growth Level (35~65)		High Growth Level (66~10)	
			No.	percentage	No.	percentage	No.	percentage
S1	114	65	25	22%	34	30%	55	48%
S2	11	20	7	64%	3	27%	1	9%
S3	30	48	10	33%	10	33%	10	33%
S4	5	81	1	20%	0	0%	4	80%
S5	22	64	2	9%	10	45%	10	45%
S6	15	34	8	53%	4	27%	3	20%
S7	5	80	1	20%	1	20%	3	60%
S8	11	43	5	45%	5	45%	1	9%
S9	25	36	11	44%	8	32%	6	24%
S10	27	61	5	19%	12	44%	10	37%
S11	14	59	4	29%	6	43%	4	29%
S12	17	42	4	24%	8	47%	5	29%
S13	21	44	9	43%	3	14%	9	43%
S14	13	71	3	23%	2	15%	8	62%
S15	7	83	0	0%	2	29%	5	71%
S16	13	41	6	46%	6	46%	1	8%
S17	16	90	1	6%	4	25%	11	69%
S18	3	43	0	0%	2	67%	1	33%
S19	9	72	3	33%	0	0%	6	67%
S20	7	49	1	14%	4	57%	2	29%

S21	6	72	0	0%	3	50%	3	50%

Note.The sum of the shares of the three growth levels does not add up to 100 percent because decimals are not retained.

The Standard Score model was employed to analyze the two waves of academic assessment data to cross-validate the findings derived from the simplified growth percentile. Initially, using data from two assessments, mean scores, standard deviations, and school-level averages were calculated for 5,413 students across 84 primary schools. Subsequently, using the standardized score model formula, standardized scores for each school in both assessments were calculated, along with corresponding Z-score gains. Ultimately, a positive Z-score gain indicates improved performance, allowing for the evaluation of instructional progress in schools implementing blended synchronous instruction. Table 2 presents the VAA results for blended synchronous instruction, derived using the standardized score model. A positive Z-score gain indicates improved instructional quality, with higher values reflecting stronger overall teaching performance.

Table 2. *Partial VAA Results of Rural BSC Teaching and Learning Based on the standardized score model*

School	The First Test		The Second Test		Z-score Value Added
	Mean Score	Standard Deviation	Mean Score	Standard Deviation	
S1	52.4	-0.52	74.4	-0.19	0.33
S2	39.9	-1.06	52	-1.45	-0.39
S3	39.5	-1.07	60.4	-0.98	0.09
S4	63.8	-0.03	85	0.43	0.46
S5	49.7	-0.63	74.8	-0.16	0.47
S6	40.9	-1.01	55.3	-1.27	-0.26
S7	88.8	1.05	92.7	0.85	-0.20
S8	40.7	-1.02	63.1	-0.82	0.20
S9	70.2	0.25	77.4	-0.02	-0.27
S10	63.3	-0.05	78.8	0.06	0.11
S11	58.4	-0.26	78.4	0.04	0.30
S12	32.1	-1.39	54.9	-1.29	0.10
S13	45.9	-0.80	64.7	-0.73	0.07
S14	35.5	-1.25	68.5	-0.52	0.73
S15	43.9	-0.88	78.7	0.06	0.94
S16	75.7	0.49	81.2	0.20	-0.29
S17	36.5	-1.20	75.1	-0.15	1.05
S18	51.3	-0.56	70.5	-0.41	0.15
S19	35.6	-1.24	64.5	-0.75	0.49
S20	66.9	0.11	77.9	0.01	-0.10
S21	44.5	-0.86	77.7	0.00	0.86

3.3 Validation of model results

School value-added scores from the simplified growth percentile and Z-score gains from the standardized score model revealed generally consistent evaluation trends across both models (see Figure 1).

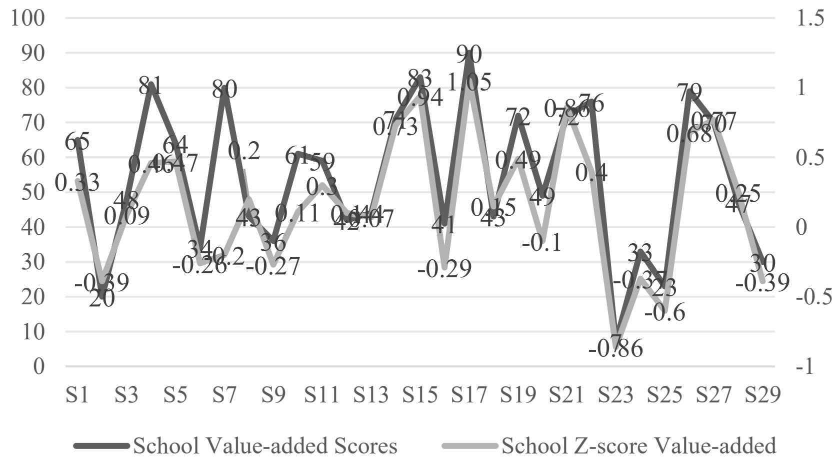

Figure 1 *Comparison of school value added based on the two models*

4. Result

4.1. The level of development of the school and its students

The student VAA data from 29 schools provides a comprehensive overview of both the overall development of the schools and the progress of individual students. Generally, the proportion of schools exhibiting normal and high growth levels surpasses that of schools categorized as having low growth levels (refer to Figure 2). Collectively, nearly 80% of the schools fall into the categories of high and normal growth, suggesting that the quality of English instruction in these schools is comparatively high. Specifically, 45% of the schools are classified at the normal growth level, reflecting a steady advancement in student learning outcomes, while 34% have achieved high growth levels, signifying robust developmental potential. Furthermore, the application of the standard score method also reveals that approximately 70% of the schools demonstrate a discernible trend of improvement.

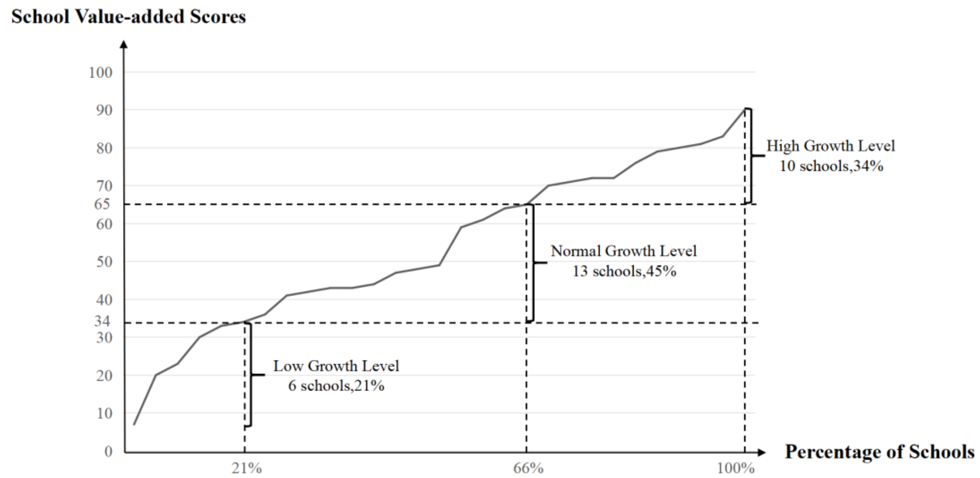

Figure 2 *Growth levels of 29 schools with rural blended synchronous instruction*

4.2. The level of student development in each school

Student growth varies within schools, and understanding individual developmental levels is essential for delivering targeted support and guidance. As shown in Table 3, students in Schools S4 and S19 exhibit both high and low growth levels, indicating considerable variation in individual academic progress. For example, in School S19, Student Pan achieved an SGP score of 98, whereas Student Peng scored only 1. This stark contrast underscores the uneven academic development among students within the same school. Reviews of blended synchronous instructional video recordings, revealed that students with lower SGP scores were generally less likely to respond to questions or initiate interactions during lessons. This lack of engagement may partially explain their limited academic progress.

Table 3. *Student growth levels in Schools S4 and S19*

School	Student	Percentile rank (SGP score)	Student Growth Level (SGP)		
			Low Growth Level (0~34)	Normal Growth Level (35~65)	High Growth Level (66~10)
S4	Jiang XX	96			√
	Yang XX	93			√
	Huang XX	81			√
	Luo XX	81			√
	Luo XX	15	√		
S19	Pan XX	98			√
	Peng XX	96			√
	Huang XX	88			√
	Pan XX	83			√
	Li XX	72			√
	Li XX	70			√
	Li XX	29	√		
	Li XX	23	√		
	Peng XX	1	√		

5. Discussion and conclusion

The purpose of this study was to analyze the effectiveness of standard blended synchronous English instruction in third-grade classrooms across 29 primary schools in a county of G Province, utilizing the value-added assessment model. The validity of the findings was further verified using the Standard Score model. In this section, key findings are summarised and discussed and directions for future research are proposed.

The results indicate that BSC instruction contributes positively to students' English learning progress across schools. Approximately 70% of students achieved the expected level of growth, and nearly 80% of schools demonstrated normal or high levels of performance improvement. This finding is consistent with the research conclusion of Huang et al. (2019): BSC instruction is generally effective in promoting student development and teaching quality in rural schools. However, variations in school-level development were observed. Video analysis further reveals that the participation and engagement of on-site teachers play a crucial role in shaping instructional effectiveness, highlighting the importance of collaborative teaching practices in BSC contexts. This finding was in concurrence with Yan et al. (2024)'s research confirming that collaborative teaching between online teachers and on-site teachers is conducive to improving student engagement, thereby influencing the teaching effect of BSC.

Despite the overall positive outcomes, significant differences in students' English learning progress exist across schools. In particular, a relatively high proportion of low-growth students in some schools constrains overall improvement in instructional effectiveness. This disparity suggests that student progress is unevenly distributed and may reflect differences in instructional practices and support mechanisms. Consequently, instructors should remain cognizant of the need to intentionally encourage and structure opportunities for remote students to engage more actively in classroom activities (Weitze et al., 2013).

Several limitations should be noted in this study. First, this study evaluates teaching effectiveness by measuring the extent of students' academic progress over a specific period. This process typically requires at least two rounds of academic data as the basis. In remote or under-resourced schools, data quality and completeness are often difficult to ensure, which may compromise the accuracy of the evaluation results. Future research could optimize the time dimension of evaluation by setting up multi-cycle assessment nodes for short-term, medium-term, and long-term periods, so as to dynamically track the process of academic value-added. Second, the sample size of the participants is insufficient to generalize the conclusion to other blended synchronous learning environments. More students and schools of different areas should be selected for a better generalizability of the conclusion.

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