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Implementing and Assessing a Teaching Mode Based on Smart Education in English Literature Teaching

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ABSTRACT

This study addresses the problems in traditional English literature teaching methods for Chinese English majors, proposing a new teaching approach based on smart education concepts to enhance learning effectiveness. An evaluation of a semester-long reform in teaching methods is conducted using a quantitative methodology. The findings reveal significant differences in learning outcomes between the experimental and control classes, suggesting the new model's positive influence on student academic performances. Machine learning algorithms are also used to analyze student classroom behavior, indicating a significant increase in active engagement. In conclusion, students' learning outcomes, as well as engagement, can be substantially improved by integrating smart education techniques into English literature instruction.

KEYWORDS:

English Literature, Smart Education, Teaching Mode, Teaching Effectiveness, Students' Academic Performances, Students' Engagement

INTRODUCTION

China, there are about 1,270 undergraduate colleges and nearly 900 of them offer English courses, about 400 of which are application-oriented universities (Ministry of Education, 2018). For English majors as EFL learners, English literature teaching came to occupy central stage in English teaching in China, and this tradition continues into the present day (Li, 1998), which is often taken as a very important compulsory course designed to broaden students' knowledge of language, culture, and history while cultivating a humanistic spirit and critical thinking, which is challenging for both teachers and students.

However, as an advanced course, with texts rich in nuance and subtlety, literature demands a great deal from both teachers' and students' comprehensive qualities, and the two parties frequently express

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difficulties and feel stressed. English literature teaching in China faces such issues as limited class hours and outdated textbooks that focus on older literature; lack of student interest and engagement, resulting in disengagement from the course; and a teacher-centered approach that hinders students' ability to develop independent analysis and critical thinking skills (Hou & Lei, 2019). In the humanities, literature is a discipline that is centered on the human being. Classroom teaching should be based on the "learner-centered" teaching methodology. Thus, teachers should be "controller, assessor, organizer, promoter, participant, and resources" (Annisa et al., 2021). Lori Varlotta, president of Hiram College, first proposed the conception of "New Liberal Art," which stresses digital technology should come into humanities study (Varlotta, 2018). In this context, the introduction of smart education, represented by artificial intelligence in classroom instruction and describes "learning in digital age" (Zhu et al., 2016), has brought new opportunities for English literature teaching in China.

Smart education entitles applications of latest or smart technologies in collaboration with advanced pedagogical practices, tools, and techniques (Kiryakova et al., 2018; Dmitrenko et al., 2023) for the effective delivery of education services (Singh & Miah, 2020). As a new trend, smart education isn't just about building and applying technology to education, but also about promoting and developing educational concepts which involves both a new understanding of teaching and the extensive and intensive use of information technology. In *Education Informatization 2.0 Action Plan* issued in 2018, the Chinese Ministry of Education simply proposed to promote the practice of smart education and integrate artificial intelligence into teaching and to drive the creation of new educational concepts, models, teaching content, and methods (Ministry of Education, 2018). In response, educators across the country have adopted interactive technologies and intelligent systems as a means to enhance students' learning experience. By use of these technologies, teachers can improve learning outcomes by personalizing instruction and providing targeted support to individual students.

In this context, the teaching of English literature in China is undergoing an innovative transformation. In face of the mismatch between traditional teaching methods and the evolving needs of students, this study aims to explore new teaching models of English literature under the framework of smart education by use of technological innovation to provide a deeper, interactive, and personalized learning experience to enhance students' engagement and understanding of the course. Through empirical research, the effectiveness of this new teaching model will be evaluated, in hopes of providing both theoretical and practical guidance for the future development of English literature education.

LITERATURE REVIEW

Smart Education

Since IBM first introduced the "Smarter Plane" strategy in its report titled *A Smarter Planet: The Next-Generation Leadership Agenda* in 2008 (Palmisano, 2008), it has sparked a global wave of research and application in smart education. Smart learning, or smart education, has been emerging with an increasing amount of research and practice since the 2010s (Li & Wong, 2021).

In 2012, Zhui Zhenting officially proposed the concept of smart education and published the article *Smart Education: A New Frontier of Educational Informatization*, which explicitly defined the fundamental principles of smart education (Zhu & He 2012). There are different scholars providing varying definitions of smart education. (Levanon, 2011; Hwang, 2014; Kim et al., 2013). However, according to Zhu et al. (2016), there is no clear and unified definition of smart learning so far, and multidisciplinary researchers and educational professionals are continuously discussing the concept of smart learning. From the perspective of educational technology, smart education emphasizes the high intelligence of the learning environment, media, technology, resources, tools, and methods (Wang et al., 2020). The concept of smart education is a relatively recent phenomenon that has emerged in the past decade, yet numerous scholars have conducted research on it across a variety of perspectives.

Some studies have focused on integrating pertinent concepts to formulate a definition or framework for smart learning. Hwang (2014) presented the definition and criteria of smart learning environments from the perspective of context-aware ubiquitous learning, and a framework is also presented to address the design and development considerations of smart learning environments. Zhu and He (2012) proposed the smart education research framework consisting primarily of five components. Some scholars explored smart learning environment or technology in smart education. Saini and Goel (2020) just conducted a survey on smart classroom technologies, and Kassab and Mazzara (2020) explored the benefits and challenges of incorporating IoTs in smart education. Yang (2014) summarized the technological features of smart education into six core characteristics. Besides, both China and countries outside of China emphasized the construction of smart learning environments supported by information technology (Zhang & Lu, 2020). From the literature, we can see that scholars have conducted theoretical research on the connotation, framework, and integration of technology in smart teaching, but how smart education is applied in curriculums and its effects is still lacking.

English Literature Teaching

Traditionally, there are at least five approaches that can be applied in teaching literature: the stylistic, the language-based, the paraphrastic, the information-based, the personal-response, and the moral-philosophical (Herlina, 2016). By reviewing literature, it's found there is a limited amount of literature available on English literature teaching. Research on literature teaching outside of China (mainly Asian countries) primarily focuses on challenges and reasons. MohdNawi & Muhmad Nor (2023) summarized the factors contributing to the challenges in middle school are mainly student-related challenges. Ainy (2007) claimed that commonly a teacher-centered approach was a popular method used in teaching literature, and the main reason for the lack of interest in the course in Bangladeshi. When it comes to the studies in China, the research mainly revolve around the current status of British literature teaching and awareness of cultivating humanistic literacy in literature and its instructional strategies. According to Li (2014), the major problems of literature teaching at Chinese universities are the insufficient motivation of students and the low efficiency of instruction. Shen (2023) proposed the cross-cultural strategy by the integration of Chinese literature in Western literature. Wu (2019) proposed the drama performance in literature teaching. Guo (2022) believed that in the context of the new liberal arts curriculum, literature courses should integrate interdisciplinary elements and intersect with other disciplines to cultivate students' critical thinking.

Research Gap and Research Hypotheses

Based on the review of the above literature, it can be found that while the research in the field of smart education is increasingly abundant, the empirical research on the application of smart education in the specific discipline of English literature teaching is relatively scarce. Key challenges in literature teaching, such as insufficient student motivation and low teaching efficiency, have been identified. In literature teaching, however, there is still a lack of research on how to address these problems through innovative teaching methods. This exposes a key research gap: the concrete implementation of smart education in English literature teaching and its effect evaluation in China. At present, the quantitative or qualitative analysis of students' learning experience and learning outcomes in smart education environment is far from sufficient, which limits people's in-depth understanding of the overall effect of smart education.

Therefore, in response to the above-mentioned gaps, this study aims to investigate the effectiveness of smart education in English literature teaching through empirical research and proposes the following two research hypotheses: First, the introduction of smart education to the literature course will effectively improve the teaching quality and students' academic performance. Secondly, the adoption of smart education in the course will significantly enhance students' interest and their learning engagement.

Redesigning English Literature Courses in a Smart Education Context

The essence of smarter education is to create smart environments by using smart technologies so that smart pedagogies can be facilitated as to provide personalized learning services and empower learners to develop talents of wisdom that have better value orientation, higher thinking quality, and stronger conduct ability. The research framework of smart education mainly consists of five components: smart education concept, smart environment, smart teaching methods, smart assessment, and smart learners (Zhu & He, 2012).

The current study designs a comprehensive pedagogical framework for the English literature curriculum that covers the five key elements mentioned above. First, the framework establishes the core concept of smart education to combine technology and education and sets the goal of improving the quality and effectiveness of English literature teaching, aiming to reshape the teaching and learning processes. In terms of building smart environments, we have introduced smart classrooms and smart learning platforms into the teaching, emphasizing the important role of digital resources in enhancing students' learning experience. Smart teaching methods integrates flipped classrooms and blended learning, with a special focus on differentiated teaching, personalized learning, and collaborative learning to increase engagement, tailoring the educational experience to individual learning styles and fostering a more interactive classroom environment. The smart assessment integrates quantitative and qualitative assessment, emphasizing multi-dimensionality to evaluate not only academic performance but also creativity, critical thinking, and teamwork. Additionally, diversity in assessment methods, such as self-evaluation, peer review, and teacher feedback, ensures a comprehensive understanding of students' learning outcomes. The cultivation of smart learners emphasizes the initiative of students in the smart education environment, encourages independent learning and critical thinking, and attaches importance to the cultivation of high-level thinking ability. The detailed framework is shown in Figure 1:

Redesigning the Teaching Environment: From Traditional Classroom to Smart Classroom With LMS

Students move from traditional classrooms to the standard smart classroom as shown in Figure 2 with several collaborative tables for off-line study. The smart classrooms have such core functions as high-quality recording, IoT central control, group writing, remote interaction, and microlearning, which is capable of accommodating a variety of teaching methods, such as group discussions, project-based learning, and other modes of instruction.

Aside from smart classroom, Learning Management System (LMS) called *Xfaike* (produced by iFLYTEK CO. LTD.) is also applied to facilitate teaching and learning. An LMS allows instructors to facilitate and model discussions, plan online activities, set learning expectations, provide learners with options, and assist in problem-solving with processes for decision making (Bradley, 2021). A typical LMS normally has the following features of course material delivery: student performance evaluation and plagiarism detection. Student tracking means to track their progress, and adaptive learning helps to provide personalized learning and immediate feedback, which is shown a in Figure 3. With these functions, the applied LMS of *Xfaike* helps to implement "Cloud+End" learning activity that includes intensive explanation about key points, quizzes and tests, homework review, group discussion, and presentation to promote more teacher-student interactions and peer interactions and strengthen the students' cognitive construction.

Redesigning the Teaching Content and Teaching Methods

A blended learning model with a flipped classroom approach is employed in the delivery of this course. The course content progresses from lower-order thinking to higher-order thinking (as shown in Figure 4), with lower-order topics covered through online learning (primarily the first and second layers), while higher-order knowledge is acquired through offline flipped classroom activities.

Figure 1. Theoretical framework

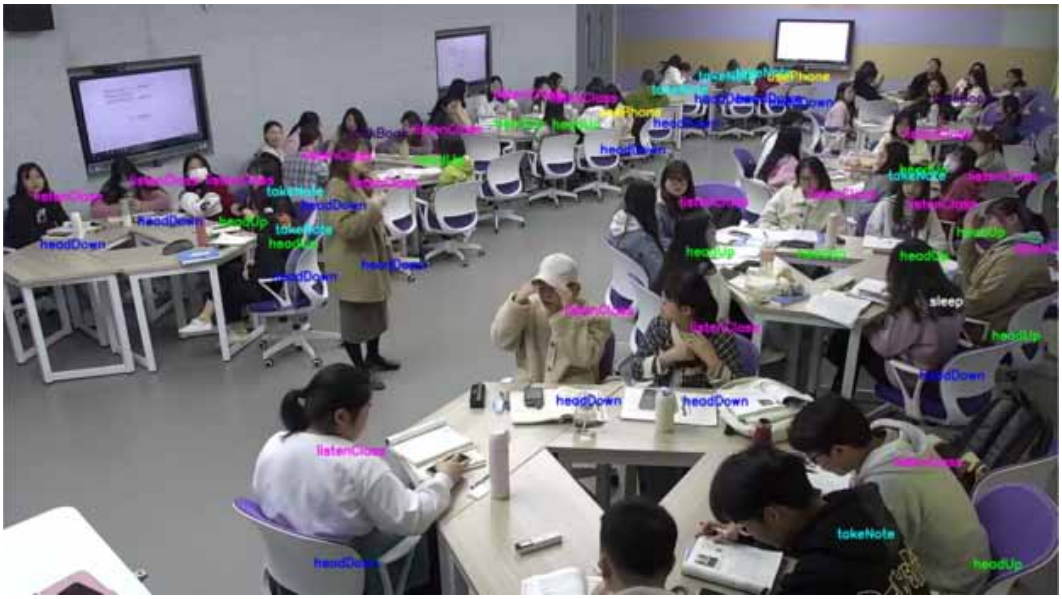


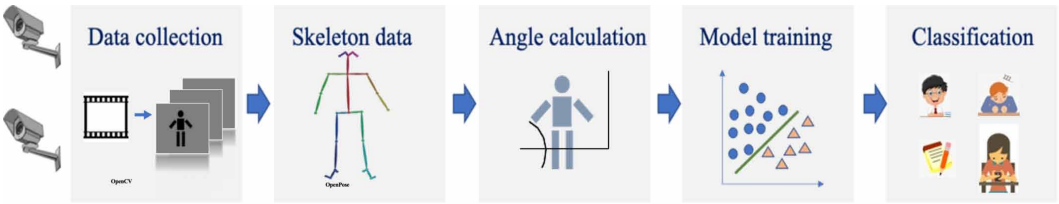
Figure 2. Standard smart classroom

The course is divided into three phases: pre- learning activities, while-learning activities, and post-learning activities, which are explained in detail as follows:

Pre-class individual learning. Before the real start of the lesson, the teacher will upload the teaching materials including syllabus, reference materials, and SPOC video covering the fundamental mnemonic knowledge to the LMS. Then the students can familiarize themselves with this basic information about the course. After that, they have to finish related online quizzes or homework and

Figure 3. The functionalities of a typical learning management system

Figure 4. Categorization of literature course knowledge



communicate with teachers and peers by posting anything about the course on BBS of LMS. At this stage, it focuses on students self-directed learning.

In-class instruction and offline flipped class. The flipped classroom model is based on the idea that traditional teaching is inverted in the sense that what is normally done in class is flipped or switched with that which is normally done by the students out of class (Nouri, 2016). After students finish pre-class individual learning by themselves, the teacher gives them tests as a warm-up activity with the *Xfaike* App or asks them to cooperate in groups to answer the teacher's questions. The *Xfaike* App can also record students' learning process data during class, such as their answers to questions and participation in Q&A sessions, and assessments of the quality of their responses are also included. Thus, an explorative atmosphere in the smart classroom is created by the real-time interactive smart platform. In this way, the teacher can evaluate students' self-study effectiveness as a basis for review, supplementation, and expansion.

After-class review. At this stage, students review and reflect on what they have learned on the smart platform and finish the homework or just communicate with teachers or peers.

After the three stages of learning, students' various abilities are fully exercised, and their involvement in the course is also greatly improved.

Course Assessment

Unlike the traditional assessment focused on students' summative evaluation, the assessment of the course after adopting blended learning is pluralistic, which is the combination of both online and offline assessment, process and summative assessment, self-assessment and peer-assessment, and quantitative and qualitative evaluation based on the platform's learning data. The details of the evaluation are summarized in Table 1. The overall evaluation includes online learning, face-to-face learning, and final exam, which contributes 25%, 25%, and 50%, respectively. In the judgment of the online learning part, we highly rely on smart tools to avoid randomness and unfairness.

METHODOLOGY

Research Questions

This study aims at investigating the effectiveness of a redesigned English literature curriculum based on the concept of smart education. The study will primarily focus on assessing the impact of the redesigned curriculum on learning outcomes and student engagement in the classroom. To this end, the goal of the analyses is to verify the learning performance attained by the students through the implementation of the new learning mode in comparison to those who have not adopted it. Consequently, we have formulated the first research question for evaluation as:

- Question 1. Does the adoption of the new learning mode result in statistically significant improvements in students' learning performance compared to traditional methods?

Given the focus on verifying student engagement in the classroom under the new learning mode, the research question could be formulated as:

- Question 2. How does the implementation of the new learning mode influence student engagement in the classroom, as evidenced by their behaviors?

Participants

The study was conducted on sophomores majoring in English from two classes in a university from Anhui Province. These two classes are parallel and intact classes, and are taught by the same English

Table 1. The detailed assessment of the course to evaluate the performance of the students

Item	Evaluation Metric	Percentage in the sub-item	Percentage in the whole evaluation
Online learning	Watching video	20%	30%
	Quiz	30%	
	Online discussion	20%	
	Notes	10%	
	Online homework	20%	
F2F learning	Attendance	10%	40%
	Quiz	30%	
	Group discussion	30%	
	Display	30%	
Final Exam	Test	100%	30%

teacher, which allows for a comparative analysis. Additonally, they are typically at a stage in their academic journey where they have a foundational understanding of English literature, making them ideal candidates to assess the impact of a new teaching method.

In terms of sample selection criteria, we have considered academic maturity, consistency, class characteristics, and willingness to participate. In particular, sophomores are chosen since they have completed the elementary English course and possess the language foundation and literature knowledge necessary for a deeper exploration of academic subjects. To minimize the influence of other variables, we maintained consistency in the content of teaching between the two classes, as well as balancing the academic backgrounds and abilities of the students. In addition, the positive attitude of students and teachers to participate in this research ensures the smooth conduct of the research. By taking into account all of these criteria, we ensure not only the representativeness of the samples, but also the validity and reliability of the results of the study.

The controlled class adopts traditional teaching, which takes place in traditional classrooms and is dominated by teacher-leading teaching methods. The students sit in the classroom and listen, and the teacher usually uses slides and textbooks to assist the teaching. The course content relies heavily on textbooks and literary anthologies, which serve as the main reading material with the teacher explaining the key points one by one. The experimental class adopts a new designed smart learning mode. Each experimental class (smart learning) and controlled class (traditional learning) consists of 57 students. Prior to the study, both of the groups were prestested. And the scores, analyzed by the independent sample t-test, suggested that there were no differences between these two classes in terms of overall English proficiency ($p=0.703>\alpha=0.05$).

Instruments

Quantative data measures were used for data collection for this study. The first instrument used in the study was the pre-test made by the researcher, which was a test of 30 objecteive items containing multiple-choice questions and fill-in-the-blank questions. These quesitons primarily assessed students' fundamental English language skills and proficiency. And this test was used to assure that the English levels of the experimental and controlled classes were the same.

The second instrument was a post-test, which is the final examination paper for both classes at the end of semester. The test consisted of multiple-choice questions, fill-in-the-blank questions, short answers, and essay questions. It aims to test students' general achievement in English literature after the experiment to measure whether smart learning is effective in enhancing students' academic performance (RQ1).

The third data collection was from each face-to-face lecture captured using the video monitoring system installed in the smart classroom. The student behavior tracking system using machine learning method was adpoted to anaylze these videos to collect students' class behaviours (RQ2).

Procedures

The researchers first conducted a pre-test among students in both the control and experimental classes to measure their English proficiency, which revealed they were consistent in terms of English level. The teacher taught students in the experimental class and control class for one semester (about 4 months). This teacher taught students in the controlled class using tradtional method, while students in the experimental class received a smart teaching mode as elaborated previously by the same teacher.

RESULTS

Normality Test of Controlled Class and Experimental Class

First, as shown in Table 2, the researchers calculated the ratio of kurtosis, skewness, and corresponding standard deviation for each group. It is found that the kurtosis and its standard deviation ratio, as well as

the skewness and its standard deviation ratio, are both within the range of ±1.96. Based on this result, it can be concluded that the data for each group satisfies the characteristics of a normal distribution.

Comparison of Pre-Test Between Experimental and Controlled Classes

In order to determine whether there is a significant difference between the experimental and control classes, an independent sample t-test was conducted. The experimental results are shown in Table 3 and Table 4.

Table 3 shows the descriptive statistics of the results of the experimental and controlled classes. The CC's mean score is 80.04, and the EC's mean score is 80.68. There is a slight difference of 0.64 of the numerical value between the two classes. It means that both groups are similar at the beginning before the experiment.

In Table 4, an independent samples t-test was used to show the scores of both groups on the pre-test. The Sig. (2-tailed) value is 0.703, which is greater than 0.05. Therefore, it means there is no significant ($p< 0.05$) difference in pre-test scores between the controlled class and the experimental class, suggesting the two groups are on the same level at the pre-test stage before the experiment.

Comparison of Post-Test Between Experimental and Controlled Classes

In order to compare whether there is a significant difference between the experimental group and the control group, an independent sample t-test was conducted. The experimental results are shown in Table 5 and Table 6.

Table 5 shows the descriptive statistics of the experimental class and the control class in the post-test. It can be found that the average score of the controlled class in the post-test is 56.05, and that of the experimental group is 66.77.There is a significance difference of 11.72 in the numerical value between the two classes.

In Table 6, an independent samples t-test is used to show the scores of both groups on the post-test. The results indicate that the difference between both groups is significant, as the p is $0.000< \alpha=0.05$. The result shows that the experimental class had better performance than the controlled class on the post-test. That is, smart learning had a significant effect on improving students' achievement in English literature study.

Table 2. Normality test

	Controlled Class (pre-test)	Controlled Class (post-test)	Experimental Class (pre-test)	Experimental Class (post-test)
Number of Cases	57	57	57	57
Skewness	0.198	0.457	-0.343	-0.321
Standard Deviation of Skewness	0.316	0.316	0.316	0.316
Ratio	0.627	1.445	-1.085	-1.015
Kurtosis	-0.287	-0.002	-0.569	-0.161
Standard Deviation of Kurtosis	0.623	0.623	0.623	0.623
Ratio	-0.460	-0.003	-0.913	-0.258

Table 3. Group statistics (pre-test of both groups)

	Groups	N	Mean	Std.Deviation	Std.Error Mean
Pre-test	Controlled Class	57	80.04	10.409	1.379
	Experimental Class	57	80.68	7.453	0.987

Table 4. Independent samples test

		Levene's Test for Equaliy of Variances		*t* Test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Internal of Difference	
									Lower	Upper
Pre-test	Equal variances assumed	4.919	.029	-.383	112	.703	-.649	1.696	-4.009	2.711
	Equal variances not assumed			-.383	101.464	.703	-.649	1.696	-4.013	2.714

Table 5. Group statistics (post-test of both groups)

	Groups	N	Mean	Std. Deviation	Std. Error Mean
Post-test	Controlled Class	57	56.05	8.234	1.091
	Experimental Class	57	66.77	9.073	1.202

Table 6. Independent samples test

		Levene's Test For Equaliy of Variances		*t* Test of Mean Value Equation						
		F	Sig.	t	df	Sig.	Mean Difference	Std. Error Difference	95% Confidence Internal of Difference	
									Lower	Upper
Post-test	Equal variances assumed	.474	.492	-6.605	112	.000	-10.719	1.623	-13.935	-7.504
	Equal variances not assumed			-6.605	110.962	.000	-10.719	1.623	-13.935	-7.503

Results From Student Behavior Tracking System

The video of each face-to-face lecture was captured using the video monitoring system installed in the smart classroom. To effectively track blended learning students, we used six typical behaviors as the indicators, including "listening lecture," "reading textbook," "sleeping," "standing," "taking notes," and "using smartphone." As shown in Zaletelj & Košir (2017), the behaviors of the students highly associated with the engagement in the class. For instance, 52% of writing note is recognized as high level engagement in the class. The author also considered the leaning forward as an indicator to monitor student tiredness in the class and to evaluate the engagement of the studying behavior. Therefore, we implement a machine learning-based recognition algorithm to track the behavior of adopting our new teaching method to verify its effectiveness. For analyzing these behaviors, the recorded video of a total of 405 minutes (corresponding to nine time slots) were analyzed. As shown in Figure 5, the analysis contains the following steps: data collection; skeleton data generation; angle calculation; model training; and classification. We now simply describe the main process of each step.

- *Data collection.* Each video with a resolution of 1080p is first converted to frames using the library tools offered by OpenCV (Bradski, 2000), since the video is in fact made up of single frame images. The obtained frames are then stored in *.jpg* format to form the original dataset.
- *Skeleton data generation.* We then adopt the OpenPose algorithm (Cao et al., 2021) to extract the skeleton data (body key-points of the students). OpenPose is an open library to detect the pose of multiple persons in a two-dimensional image based on a convolutional neural network (Yamashita et al., 2018). Since it is open and available at github, we can easily utilize and ignore the technical details. By using this algorithm, the students' skeleton data with key-points are formed. As shown in Figure 6, the students and the instructor are properly detected. Moreover, the obtained images with the skeleton key-points are shown in Figure 7. Based on the results, the OpenPose algorithm performs well in this scenario.
- *Angle calculation.* In general, a different human behavior generates different angles between two key points associated to that behavior. To this end, the angle is calculated using the obtained skeleton data. In this work, we selected 25 key-points in the student's body to evaluate the angle, as shown in Figure 7. Together with the x-y coordination, the angles are then obtained using the elementary angle calculation of two coordinates. The skeleton data with the obtained angles are then forwarded to the machine learning algorithm for further processing.
- *Model Training.* The skeleton dataset is partitioned into a training set and a validation set. We use the training set to train the support vector machine (SVM) model (Cortes &Vapnik, 1995) to obtain the proper learning model for deploying.
- *Classification.* Finally, the validation set is adopted to test the performance of the obtained SVM model. As shown in Figure 8, the behaviors are recognized and labeled.

The percentage of the behavior is summarized in Table 7. Four metrics are adopted to verify the recognizing performance of the students' behaviors, as precision, recall rate, score, and support. The precision indicates the rate between the true positive prediction and all the positive prediction. The recall rate is the ratio between the true positive and the true positive pluses the false negative, which shows the sensitivity of the classifier to the positive examples. The F1-score is obtained by $2 \times$ (precision $\times$ recall rate)/ (precision + recall rate) representing the harmonic mean. The support value represents the number of supported samples. In general, the learning accuracy is acceptable, especially for these normal behaviors with enough support samples. Due to the lack of enough samples for "sleeping" and "standing" behaviors, the prediction accuracy is not sufficiently high as expected. According to the results, it verified that the interaction is highly active and most of the students concentrate on the courses, indicated by the prediction of "listening," "reading textbook," and "taking note," 87.8%. The current study verified a notable correlation between posture in class and student performance. By utilizing the status quo machine learning algorithms for posture recognition, we observed that the student in our designed blended learning class achieved a high-level engagement that significantly aligns with their academic performance. This finding is in line with existing work, such as D'Mello et al. (2007), which indicates that certain postures can reflect levels of engagement and cognitive involvement.

The posture recognition algorithm identified specific postures related to higher engagement levels, such as upright sitting and forward-leaning positions. This aligns with studies like those by Nomura et al. (2019), which suggest that specific postures are indicative of active engagement and better cognitive processing. In our study, these postures were consistently associated with better performance in assessments, suggesting a tangible link between physical engagement, as manifested in posture, and academic success.

The insights from our posture analysis offer a unique perspective on how physical events can be an indicator to mental engagement in a learning environment. By understanding these correlations, educators can create more responsive and dynamic learning settings. For instance, recognizing signs of disengagement through posture can prompt timely interventions to re-engage students, potentially

improving their academic outcomes. For enhance the teaching, student's behaviors can also be correlated with knowledge points. The teacher can then adjust and assign more time to a knowledge point if the students perform poorly according to the recorded behavior. In the future, we can associate the behaviors with the points and atomically generate the evaluation of the students during class, which significantly improves the fairness and reduces the effort of the teacher. In fact, based on the results of the experimental class students' behavior, the student behavior tracking system enhances the evaluation of students.

However, due to the nature of smart learning, there are many tasks distributed to the students in class. They need to finish these tasks using smartphones or desktops. Hence, the ratio of using smartphones is quite high, 8%, compared to a conventional class. (Using smartphones is not good in conventional classes since it is a distraction.) It should be emphasized here that the analysis in a smart classroom is different from that in a conventional classroom. The reason is that the students in a conventional classroom are facing the instructor. To improve the prediction of the students' behavior in the smart classroom, more data samples should be collected, and the learning algorithm should be adjusted accordingly. This is left for a future study for precisely predicting student behavior in the smart classroom.

DISCUSSION

Based on the previous results and analysis, it can be seen that both the experimental class and the controlled class have similar levels of English proficiency and language ability in the pre-test results. After the smart education experiment, there is an obvious difference in the results of the post-test between the experimental class and the controlled class. From the results of the experimental class students' behavior, the student behavior tracking system indicates a significant increase in students' interactive activity and engagement in the classroom. In this class, the vast majority of students are able to focus on their studies, and their devotion in activities such as listening to lectures, reading textbooks, and taking notes has reached a high proportion. In addition, students mainly use smartphones to support their learning in class, with fewer distractive behaviors like sleeping. This study adds to the growing body of evidence suggesting a strong connection between physical posture and academic performance. The use of posture estimation through machine learning presents a novel approach to understanding and improving student engagement and learning outcomes, which was confirmed in the previous studies (D'Mello et al., 2007; Nomura et al., 2019; Zaletelj & Košir, 2017).

This study has demonstrated that the reconstructed English literature curriculum based on the smart education concept significantly affects students' academic performance and classroom engagement. In a smart education environment, the teacher's role has changed profoundly and has had a profound impact on students' learning. Teachers are evolving from traditional knowledge transmitters into instructors and facilitators, and they are more likely to guide students on how to effectively

Table 7. The results of recognizing student behaviors in a recorded video lecture using machine learning

Defined behaviors	Precision	Recall rate	Score	Support
Listening	0.87	0.83	0.85	2554
Reading textbook	0.74	0.12	0.21	1617
Sleeping	0.46	0	0	27
Standing	0.53	0.09	0.15	233
Taking note	0.63	0.64	0.63	1231
Using smartphone to join discussion	0.75	0.19	0.30	494

Figure 5. Workflow of analyzing the students' behaviors in class using machine learning algorithms

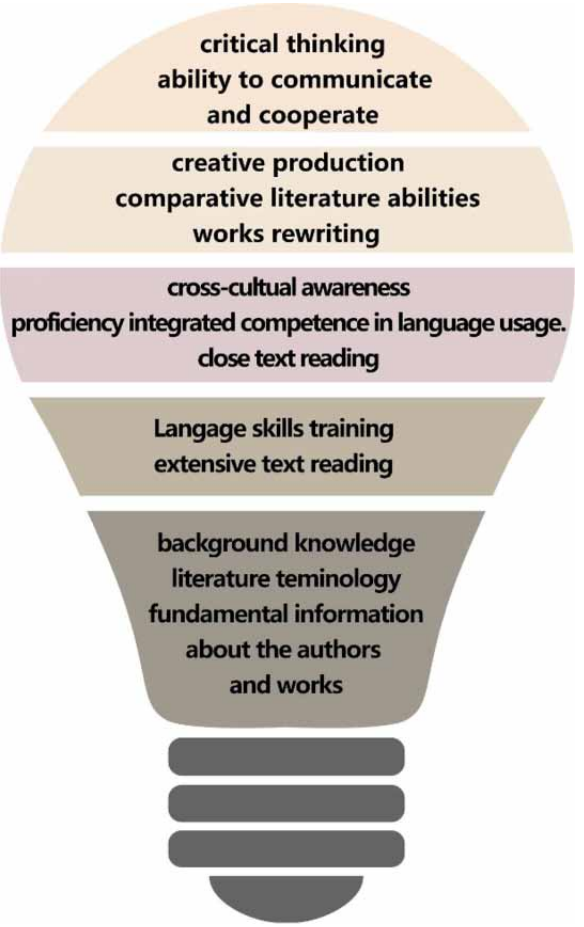


Figure 6. Students and instructor detection using machine learning algorithms

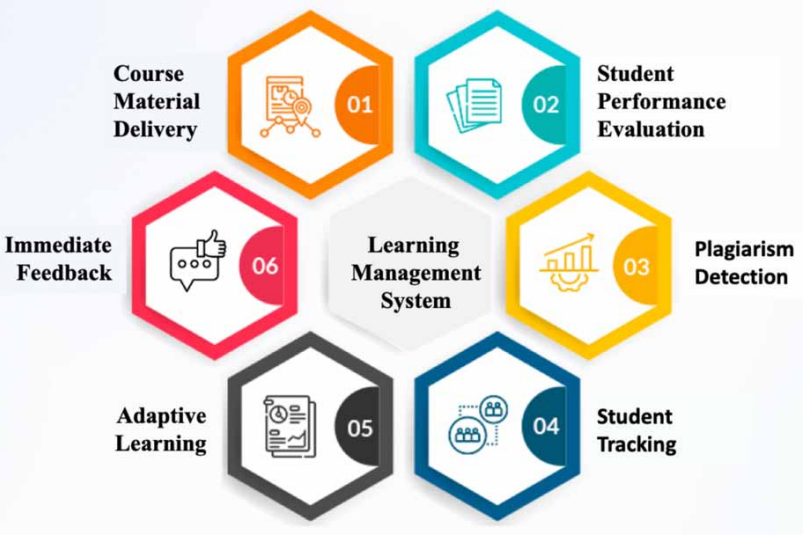
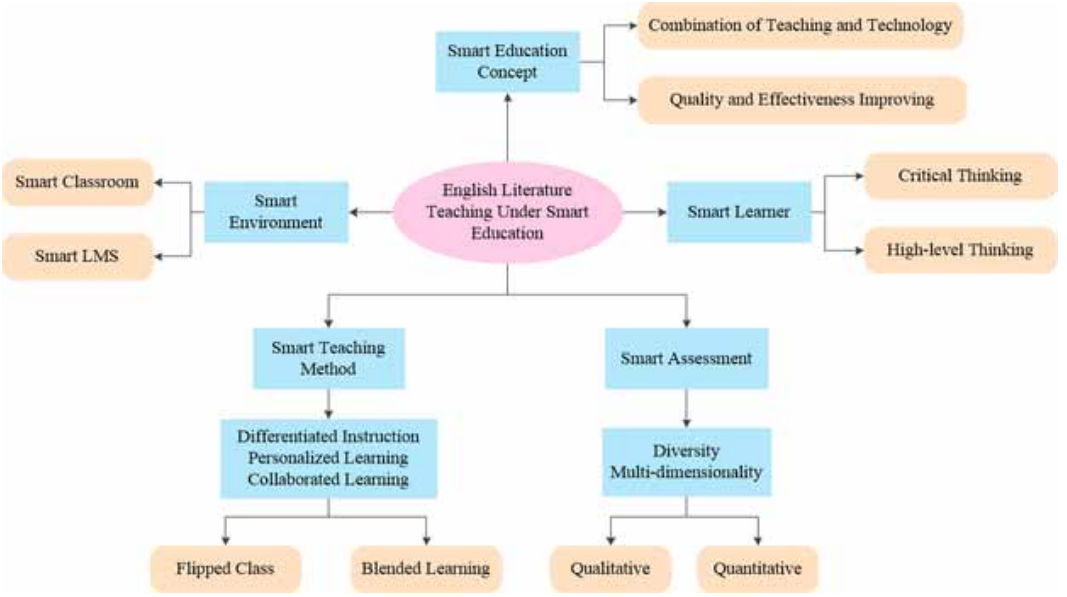


Figure 7. Skeleton data detected in machine learning algorithms

Figure 8. Recognized behaviors and their tags



use smart education tools for self-learning. By adopting this new approach, students are not only encouraged to explore and understand English literary concepts but are also encouraged to develop self-directed learning skills. This change not only encourages students to explore and understand English literary concepts but also to foster the development of their ability to learn independently.

By integrating modern technology and rich resources, this new teaching model greatly enhances the learning experience. A wide range of online resources and interactive features on the smart platform provide students with a broader selection of learning materials, which increases their engagement and motivation to learn. By creating an interactive and collaborative learning environment, the smart classroom allows students to participate more actively in class discussions and to have a deeper understanding of literary works.

Finally, this study indicates that intelligent instructional design can be applied to a wider range of subjects and levels of education than just English literature courses. Its success shows how modern technology and innovative teaching methods can significantly enhance the quality of teaching and the learning outcomes for students. Therefore, future research should focus on how to more effectively integrate these teaching models into different disciplines and educational settings, and how to further develop and optimize smart education tools and strategies to adapt to the changing and evolving needs of the educational industry. In addition to promoting the modernization of education, such exploration can also result in a more rich and meaningful learning experience for students.

CONCLUSION

This study explores the teaching mode of English literature teaching course using quantitative research and machine learning methods; however, some research limitations still exist. Due to the limited number of experimental samples, the experimental results may only represent the performance of a certain sample size. Additionally, multiple modern technological tools have been applied in this study, therefore, promoting the proposed teaching mode to a wider range of educators poses significant challenges. Despite these challenges, the positive outcomes of smart education in enhancing both learning quality and the educational experience are undeniable. The course of English literature is a crucial curriculum that enhances students' different abilities in English study in China, but it is a challenging task for English majors. To fully reap the benefits of smart education, we have carefully designed a teaching strategy based on the smart concept. The results of the study demonstrate the significant potential for smart education to transform the English literature curriculum. By implementing a set of well-designed teaching strategies that emphasize student-centered and teacher-leading teaching models, we are able to respect student personality differences and foster innovation and creativity, thereby eliminating traditional passive learning methods. It is clear from the evaluation results that smart learning concepts are effective in improving the quality of curriculum instruction. The utilization of smart education not only enhances learning outcomes but also enriches the educational experience for students, setting a precedent for future applications.

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CONFLICTS OF INTEREST

The authors report there are no competing interests to declare.

DATA AVAILABILITY

The authors confirm that the data supporting the findings of this study are available within the article.

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