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Empirical Investigation and Analysis of Learner Learning Effectiveness in Open Education Online and Offline Teaching in the Digital Age

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Abstract:
With the rapid development and popularization of Internet technology, offline teaching in the age of digital intelligence has gradually become an important part of the education field, which together with traditional offline teaching forms a diversified teaching model. Study aims to provide useful references for educators through comparative analysis, in order to better combine the advantages of two teaching modes and improve learners' learning outcomes. At the same time, the study focuses on the psychological anxiety of open education learners in the process of online learning. Through empirical investigation and analysis, the impact of learning anxiety on online learning effectiveness is revealed, and the relationship between anxiety and learning behavior is explored. This study conducts an in-depth comparative analysis of the learning outcomes of online and offline teaching from the perspective of open education in the digital age. The research results show that online teaching exhibits significant advantages in flexibility, resource diversity, and personalized learning. Learners can learn anytime, anywhere without being limited by time and space, and the teaching resources are rich and diverse, which can meet the personalized needs of different learners. However, online teaching also has some shortcomings, such as insufficient teacher-student interaction, high demands for learner self-discipline, and relatively weak learning atmosphere, which may to some extent affect learning outcomes.

Keywords: digital age open education, online teaching, offline teaching, learning outcomes, contrastive study

INTRODUCTION

The teaching in the era of digital intelligence is undergoing profound changes, mainly reflected in the transformation of teaching modes, resource acquisition, evaluation systems, and teacher roles. The teaching mode has undergone significant changes in the era of digital intelligence. The traditional binary structure of teachers and students is transforming into a ternary structure of teachers, machines, and students [1]. The integration of digital and intelligent technologies has made classroom teaching no longer limited to traditional teaching methods, but more reliant on intelligent devices, big data, and other technologies for precise teaching and learning situation diagnosis. This transformation not only improves the efficiency and effectiveness of teaching, but also makes teaching more personalized and intelligent. Resource acquisition has become more convenient and abundant in the era of digital intelligence. Digital technology makes the production and dissemination of educational resources easier, and students can access a large amount of learning resources and information through the internet [2]. At the same time, intelligent technology can also recommend relevant learning resources and courses for students based on their learning needs and interests, thereby achieving personalized recommendation and acquisition of resources. The evaluation system is also facing changes in the digital age. Traditional evaluation methods often focus on assessing students' knowledge mastery, while in the era of digital intelligence, the evaluation system places more emphasis on the development of students' comprehensive qualities and abilities. Through digital and intelligent technologies, students' learning processes, outcomes, and attitudes can be comprehensively evaluated, thus more accurately reflecting their true level and development potential [3]. The role of teachers has also undergone significant changes in the era of digital intelligence. Teachers are no longer just transmitters of knowledge, but have become guides for students' learning and creators of situations. Teachers need to have high digital literacy and be able to make good use of digital technology for teaching innovation and personalized teaching. At the same time, teachers also need to constantly learn and update their knowledge and skills to adapt to the teaching needs and development trends of the digital age [4]. With the in-depth development of Internet technology, online learning has been favored by more and more learners, especially in the epidemic environment of the past three years, online teaching has provided great teaching support for all kinds of education and teaching. It can be said that the organization of online teaching has greatly promoted the major reform of education and teaching, especially the selection, utilization and resource development of information technology means in

teaching, which has promoted the development of current intelligent education [5]. But we should also have a clear and rational view of the shortcomings of online teaching, grasp the commonalities and differences between online and offline teaching, balance the advantages and disadvantages of online and offline teaching, and have greater significance in solving students' perception and gains of knowledge, and promoting the deep integration of online and offline teaching. Researchers conducted a comparative study between traditional face-to-face teaching and online learning for learners, identifying differences and similarities in learning outcomes, and attempting to better address some of the problems that exist in open education teaching models [6]. In the online learning environment, learners face a completely different learning experience from traditional classrooms. They need to independently complete learning tasks without direct teacher guidance or face-to-face communication with classmates. This self-directed learning approach places higher demands on learners' self-discipline, self-management skills, and information processing abilities. However, many learners often experience anxiety while adapting to this new environment. This anxiety may stem from doubts about the quality of online teaching, discomfort with course presentation, helplessness in information processing, and concerns about learning outcomes. Open education online learners may experience anxiety due to concerns about the quality of online teaching and doubts about learning outcomes. They may feel that online courses lack the interactivity and instant feedback of traditional classrooms, making it difficult to ensure learning outcomes. In addition, facing massive amounts of online information and complex course presentation methods, learners may feel lost and even experience information confusion, further exacerbating their anxiety [7]. In addition to the above factors, learners' personal characteristics and environmental factors are also important factors affecting psychological anxiety in online learning. For example, adult students may have a strong dependence on traditional teaching methods and find it difficult to adapt to the teaching mode and learning methods of open education. At the same time, they may also face various social pressures such as family and work, which can exacerbate anxiety during the online learning process.

Therefore, research on the psychological anxiety of online learners in open education is of great significance. It not only helps us gain a deeper understanding of the psychological state and learning needs of online learners, but also provides targeted guidance and suggestions for the teaching practice of open education [8]. By optimizing the presentation of online information, providing good educational services, and teaching learners how to learn, we can help learners maintain an appropriate level of anxiety in online learning, thereby improving learning efficiency and effectiveness.

DESIGN AND IMPLEMENTATION OF RESEARCH

Experimental Methods

This article is assessed through two methods: pre-test experiments and post test experiments. The pre-test is important to obtain the average scores of students in two classes by examining the test content. The purpose is to correctly analyze the mastery of classroom knowledge by students in the two classes under the traditional teaching mode before the comparative experiment; The importance of post testing is to use comparative experiments to determine the level of mastery of textbook knowledge in offline and online teaching, identify the gap between the two, and conduct targeted analysis of problems.

Experimental Purpose

With the application of teaching informatization means in teaching, online teaching, which takes Internet technology as the mainstream, has become a common teaching means in schools at all levels. It can effectively use network teaching in open education teaching, make up for the shortcomings of offline teaching, optimize teaching effects, and comprehensively promote the teaching quality of open education [9]. This article investigates and studies the testing materials, and identifies the advantages and disadvantages of online and offline learning effects, providing effective data support for the application of information-based teaching methods in open education.

EXPERIMENTAL STEPS

Principal and Subject

Principal investigator

Information technology teachers from a certain university, who have been engaged in open education teaching for more than ten years and are relatively familiar with the development of open education teaching models, have a high enthusiasm for this teaching experiment, and have had good communication with the author. He will serve as the experimental class using online teaching on the application of Excel formulas and functions in the "Fundamentals of Computer Applications" lesson (experimental class), and the comparative class (using offline teaching, blackboard, etc.).

Participants

Two classes in the 22nd grade of a certain university's junior college, with a total of 52 students in Class 3 and 54 students in Class 4. In order to reduce data errors in experiments and surveys, 50 students were selected from each class in the test. Class 4 serves as the control group for this experiment, teaching in the traditional face-to-face manner; Class 3 is an experimental class, which uses the current Internet for online live teaching. The two classes selected for this experiment have a relatively similar level of knowledge mastery.

Experimental Time and Teaching Methods

Experiment time

Divide the teaching content of "Fundamentals of Computer Applications" into three lessons on the application of Excel formulas and functions, with each lesson lasting 45 minutes (this course content is for pre-test assessment); The teaching content of the course "Fundamentals of Computer Applications" is divided into three lessons, each lasting 45 minutes (this section is for post test assessment), for a total of six lessons. The experimental period is one week, and the learning of this course is completed.

Teaching method

The control class (four classes) adopts traditional teaching methods. In the control class, traditional teaching methods are used for classroom lectures. Teachers explain classroom knowledge face-to-face, and students have a high level of focus and a thorough understanding of the knowledge. Students' extracurricular assignments are exercises in the textbook. The experimental class (Class 3) uses the modern Internet for teaching. In the teaching of this class, the subject teacher mainly designs teaching according to the formulated teaching plan, assigns learning tasks, creates certain teaching scenarios in teaching, and can ensure that students complete their respective learning tasks; Students, as the main participants, participate in teaching activities with complete autonomy. Teachers, as organizers of teaching activities, promptly identify problems in students' learning process, provide guidance and guidance in a timely manner, and students complete scenario teaching according to teaching points, teaching reference materials, exercises, etc. Online teaching mainly refers to teachers guiding students to master knowledge points correctly, guiding students on how to quickly grasp the core points and content of course knowledge, guiding students to think, explore, experience, and cultivate their ability to solve problems. Animation display is important in using visual forms to enable students to achieve sensory understanding. This form is mainly aimed at mobilizing students' enthusiasm for learning and their ability to learn independently.

Experimental Tools

The pre-test and post test content of the two classes in the local experiment, as well as the experimental and control classes, are all based on the knowledge points of the lesson "Fundamentals of Computer Applications".

Prepare two sets of test papers suitable for testing the content of this test for two classes. These two sets of test papers have similar question types and scores, and are named Test 1 (Knowledge Points of Computer Application Fundamentals) and Test 2 respectively.

Evaluation of teaching effectiveness. In order to make the results of this experiment more practical, all the test papers are objective questions, with 5 points per question, for a total of 100 points (the purpose is to avoid the influence of teacher grading factors in subjective questions on the validity of this experiment). The exam method

is a closed book exam with a duration of 30 minutes, and the exam will be immediately closed on the spot upon expiration. The evaluation of classroom teaching effectiveness cannot be solely based on grades, but should take into account students' cognitive, emotional, and previous knowledge mastery levels in combination with actual situations. In this experiment,9commonly used indicators reflecting classroom teaching effectiveness were proposed. Through the "Classroom Teaching Effectiveness Questionnaire Survey", the top 9 items with high confirmation rates were obtained from the 200 collected questionnaires as the measurement indicators for this test material.

The definitions of these nine indicators are:

Learning motivation (M1): refers to the initiative of attracting students to participate in classroom learning through teaching.

Learning efficiency (M2): Learning efficiency refers to the speed and quality of learning knowledge per unit of time. It is an important indicator of a person's learning ability and a key factor in determining their academic achievement and career development.

Comprehensive effect (M3): refers to the ability to achieve optimal results by combining multiple methods.

Inspirational thinking (M4): refers to a way of thinking that solves problems through simplified strategies and rules. It aims to reduce the complexity and information load in the decision-making process, helping to make quick decisions and solve problems.

Enhancing imagination (M5): refers to enriching students' imagination through teaching.

Mastering difficulties and key points (M6): Teaching and learning highlights the key and difficult points, making it easy to master.

Expanding knowledge (M7): refers to teaching that can greatly enrich students' knowledge.

Improving spoken English (M8): refers to a systematic and continuous process that involves multiple aspects of practice and strategies.

Concentration (M9): Refers to putting all one's energy into studying and focusing on studying.

Based on the evaluation system of students' evaluation of the teaching effectiveness of online and offline learning, the above nine indicators are divided into four levels: excellent, good, medium, and poor, and are quantified with 9 points, 8 points, 6 points, and 4 points, respectively. A two-dimensional test form, "Classroom Teaching Effectiveness Survey Form", is designed according to the above quantitative values, as shown in Table 1.

These four levels are:

Excellent: Refers to students having a high level of focus on teaching and demonstrating a high level of enthusiasm for learning.

Good: Refers to students' basic satisfaction with the teaching effectiveness.

Middle: Refers to students having average teaching effectiveness and low initiative.

Poor: Refers to students' dissatisfaction with teaching feedback and relatively poor learning initiative.

Table 1. Classroom teaching effectiveness survey form

	excellent	**good**	**average**	**poor**
M1				
M2				
M3				
M4				
M5				
M6				
M7				
M8				
M9				

Operation Steps

Pre test

The two classes test the use of classroom face-to-face teaching for teaching. Before the experimental students use Internet technology to use online teaching, they conduct the first survey of the teaching of various materials and knowledge points used by the two classes.

Post test

After completing the experimental content in the experimental class, conduct another survey on the above content in both classes.

Academic performance

before the online teaching of the experimental class, the students' scores of the manual test are taken as the scores of the students on the front and side boards. After the online teaching of the Internet is completed, the students' scores are obtained from the same content by means of a second test, which is more objective.

EXPERIMENTAL RESULT STATISTICS

Pretest

In order to ensure consistency in the teaching statistics scores of the two classes, both classes in the preliminary test will first use online teaching. The evaluation results of various indicator systems reflecting teaching effectiveness in the testing of the above teaching content are shown in Table 2.

Table 2. Pre test results of experimental and control classes

	Number of participants in the experimental class: Unit (s)				**Number of participants in the comparative class: Unit (s)**			
	excellent	good	average	poor	excellent	good	average	poor
M1	7	22	15	7	5	24	11	10
M2	4	23	17	6	4	32	10	4
M3	5	35	8	2	3	29	17	1
M4	10	12	24	4	7	21	14	8
M5	6	23	20	1	3	24	21	2
M6	8	23	16	3	10	22	12	6
M7	2	12	31	5	3	16	24	7
M8	3	22	17	8	8	24	12	6
M9	3	32	10	5	2	29	12	7

Post Test

The students in the experimental class completed the online teaching completion test, and a second phase survey was conducted on the preliminary data as shown in Table 3.

Table 3. Post test results of experimental and control classes

	Number of participants in the experimental class: Unit (s)				**Number of participants in the comparative class: Unit (s)**			
	excellent	good	average	poor	excellent	good	average	poor
M1	13	24	10	3	4	22	20	6
M2	14	22	12	2	6	28	12	4
M3	15	13	20	2	4	25	11	10
M4	16	19	12	3	7	17	20	6
M5	26	13	8	3	2	24	18	6
M6	18	23	6	1	8	18	20	4
M7	22	18	10	0	3	16	28	3
M8	10	22	10	8	6	14	30	0
M9	34	7	8	1	4	21	22	3

Comparison of Test Scores between Two Classes

Exam scores are the most objective indicator of classroom teaching in this test. Therefore, two tests were conducted on students. The pre-test was conducted on both classes before the experimental class started online teaching; Post test is a test conducted on experimental class students after online teaching. As shown in Table 4

Table 4. Average scores of pre-test and post test for the experimental and control classes

	Pre test (100 points scale)	post test (100 point)
Experimental Class	87.54	85.37
Comparison class	86.32	84.21

DATA ANALYSIS

Based on two surveys of the experimental and control classes, the average values of each item in the pre-test and post test of the two classes can be obtained by quantifying the values of "improving skills", "learning efficiency", "inspiring thinking", "expanding knowledge", "comprehensive effect", "focusing attention", "mastering difficult key points", "improving imagination", "learning enthusiasm", as well as the values of "excellent", "good", "medium", and "poor", as shown in Table 5.

Table 5. Various data of pre-test and post test for experimental and comparative classes

			M1	M2	M3	M4	M5	M6	M7	M8	M9
Experimental class	pre-test	average value	7.14	7.23	7.21	7.54	6.89	7.32	7.06	7.09	7.21
		standard deviation	1.82	1.24	1.73	1.65	1.27	1.13	1.09	1.45	1.43
	Posttest	average value	7.78	7.62	7.23	7.45	7.75	7.82	7.25	7.77	7.68
		standard deviation	1.45	1.63	1.72	1.82	1.46	1.54	1.98	1.24	1.34
control class	pre-test	average value	6.83	7.01	6.92	6.43	6.52	6.27	6.74	6.45	6.24
		standard deviation	1.24	1.74	156	1.82	1.17	1.43	1.67	1.87	1.45
	Posttest	average value	6.87	6.75	6.54	6.91	6.36	6.82	6.78	6.45	6.38
		standard deviation	1.54	1.63	1.57	1.59	1.65	1.71	1.69	1.76	1.43

Overall Average Value

In this research data testing, a comparative research method combining single group and equal group experiments was used. The test sample size in the experiment was 40, i.e. n 20. The overall statistical results of the pre-test and post test in two classes are shown in Table 6.

Table 6. Overall average values of pre-test and post test for the experimental and control classes

		pre-test	Post-test	z value	significance
Experimental class	population mean	7.13	7.76	1.87	Approaching 0.05
	Overall standard deviation	1.82	1.75		
control class	population mean	6.78	6.97	0.12	Greater than 0.05
	Overall standard deviation	1.84	1.78		
z value		0.49	2.37		
Significance (P)		Less than 0.05	Greater than 0.05		

Note: P is less than 0.05, indicating a significant difference; P is greater than 0.05, indicating no significant difference. The significance level is a concept closely related to research hypotheses, which determines the

probability of hypothesis rejection in statistical testing. In the field of educational research, researchers typically set two common significance levels: 0.05 and 0.01, which are also known as alpha levels [10].

According to the data in Table 6, in terms of a single group experiment, the difference in the average overall effect between the two tests before and after the control group was statistically significant, with a Z-value of 0.11, which is much smaller than 1.96 (with a significance level P-value of 0.05), indicating no significant difference (P>0.05); The Z-value of the two tests before and after the experimental class was 1.87, which is very close to the critical value of significant difference (1.96), indicating that the difference in this experiment is quite significant. From the data of the equal group experiment, there was no significant difference in the overall average of the early data between the two classes, with a Z-value of 2.37, which is P>0.05; However, there was a significant difference in the post test between the two classes, with a Z-value of 0.49, indicating a P value less than 0.05.

The following experimental results show that when both classes adopt traditional offline teaching methods, students' feedback on the teaching effectiveness of the same teacher is roughly the same, indicating that the learning effectiveness of the two classes is equivalent without the interference of other variables. However, when online teaching (i.e. multimedia teaching) was introduced in the experimental class, there was a significant change in students' understanding and attitude towards the teaching content, which was positive and obvious, reflecting the advantages of multimedia teaching compared to traditional teaching methods. Therefore, it can be concluded that online teaching (or multimedia teaching) has a positive promoting effect on improving teaching effectiveness and efficiency [11]. Online teaching, due to its unique advantages, can effectively improve students' learning outcomes and teachers' teaching efficiency.

Single Item Average Value

The average values of the pre-test and post test of the control group were similar in the pre-test of the control group and the experimental group, and there was no significant difference in the average values of various indicators. The standard deviation also tended to be consistent, and the statistical significance result was P>0.05; However, in the post test, there was a significant change in the average values between the experimental group and the control group. Specifically, before the experiment began, a pre-test was conducted on the control group and experimental group to evaluate their initial level of proficiency in the tested content. The pre-test results showed that the average values of the two classes on various indicators were very close, indicating that their levels were similar before the start of the experiment. At the same time, the standard deviations of various items also tend to be consistent, further indicating the similarity in data distribution between the two classes. The statistical significance result is P>0.05, which means that the hypothesis that the pre-test scores of two classes are the same cannot be rejected statistically, that is, there is no significant difference in pre-test scores. See Tables 7 and 8.

As shown in Tables 7 and 8, the average values of indicators such as "learning motivation", "learning efficiency", and "improving oral English" have undergone significant changes, and the degree of improvement is very significant (P>0.01 or P<0.05). This indicates that online teaching has had a positive impact on teaching content, resulting in significant improvements in these aspects., The large and significant changes in the average value of "learning motivation" indicate that online teaching methods may stimulate students' interest and motivation in learning, making them more actively involved in the learning process. This increase in motivation helps students maintain sustained attention and engagement in their studies, thereby improving learning outcomes. Meanwhile, the significant improvement in "learning efficiency" also demonstrates the advantages of online teaching. Online teaching may help students absorb and master knowledge more effectively by optimizing teaching resources and providing personalized learning paths, thereby improving learning efficiency. This efficiency improvement enables students to achieve the same or better learning outcomes in a shorter amount of time.

In addition, the significant change in the indicator of "improving spoken language" is particularly important in language teaching. It indicates that online teaching may adopt more effective teaching methods and means in oral training, such as real-time interaction, simulated dialogue, etc., to help students exercise and improve their oral skills in actual communication., This indicates that online teaching has greatly improved the presentation of teaching content; In terms of the average values of indicators such as "comprehensive effect" and "inspiring thinking", there has also been varying degrees of improvement, while the average values of "mastering key and difficult points", "concentrating attention", and "expanding knowledge" have shown a decrease (P<0.01, or

P>0.05), indicating that their effectiveness is not as good as traditional teaching. From this, it can be seen that multimedia courseware can achieve good results in teaching overall, but not in all aspects. Its effects have both advantages and disadvantages. Therefore, in classroom teaching, it is necessary to combine reality and achieve the organic unity of online and offline teaching.

Table 7. Single item average values of pre-test and post test in the experimental class

			M1	M2	M3	M4	M5	M6	M7	M8	M9
Experimental class	pre-test	average value	7.14	7.23	7.21	7.54	6.89	7.32	7.06	7.09	7.21
		standard deviation	1.82	1.24	1.73	1.65	1.27	1.13	1.09	1.45	1.43
	Posttest	average value	7.78	7.62	7.23	7.45	7.75	7.82	7.25	7.77	7.68
		standard deviation	1.45	1.63	1.72	1.82	1.46	1.54	1.98	1.24	1.34
z value			4.12	2.38	1.65	1.43	1.76	6.01	5.32	6.41	4.01
P value			> 0.01	< 0.05	< 0.05	> 0.05	> 0.01	> 0.05	> 0.05	< 0.01	< 0.05

Table 8. Single item average values of pre-test and post test for experimental and control classes

			M1	M2	M3	M4	M5	M6	M7	M8	M9
Experimental class	pre-test	average value	7.78	7.62	7.23	7.45	7.75	7.82	7.25	7.77	7.68
		standard deviation	1.45	1.63	1.72	1.82	1.46	1.54	1.98	1.24	1.34
control class	Posttest	average value	6.87	6.75	6.54	6.91	6.36	6.82	6.78	6.45	6.38
		standard deviation	1.54	1.63	1.57	1.59	1.65	1.71	1.69	1.76	1.43
z value					1.25	1.13	1.96	7.01	5.42	6.01	4.51
P value					> 0.05	< 0.05	< 0.01	> 0.05	> 0.05	< 0.01	> 0.05

Based on the pre-test and post test analysis of the nine teaching effectiveness indicators, the experimental class showed three different effects in the nine indicators: "excellent", "good", and "poor". The test indicators for these three situations showed significant differences in items such as "learning interest", "learning efficiency", and "improving oral English". This indicates that online teaching has a significant effect on classroom teaching in these areas. The indicators of "comprehensive effect", "inspiring thinking", "expanding knowledge", and "focusing attention" have all shown good results, but there are differences in the degree of improvement of each indicator. Especially for the indicator of "comprehensive effect", the statistical Z-value of the pre - and post tests in the experimental class reached 1.76, significantly reflecting the positive changes in students' overall perception of classroom teaching, which is highly consistent with the overall average test results. It also indicates that using online teaching can bring students a good learning experience and promote the effectiveness of teaching. However, the statistical results for "expanding knowledge", "concentrating attention", and "mastering key and difficult points" show no significant effect. This indicates that computer multimedia courseware lacks flexibility, knowledge coverage, and control over students in teaching applications.

Comparison of Student Exam and Test Scores

The statistical results of the two tests before and after the two classes are shown in Table 9.

Table 9. Statistical results of pre-test and post test for the experimental and control classes

		pre-test	Posttest
Experimental class	average value	87.54	85.37
	standard deviation	12.4	17.9
control class	average value	86.32	84.21
	standard deviation	13.3	16.4
z value		1.04	2.39
P value		> 0.05	> 0.05

Based on the analysis of the two tests conducted in the experimental class and the control class, the significant values (P) for both classes with the same score system and exam content are greater than 0.05. This means that although the use of online teaching has a good effect on bilingual classroom teaching, compared with traditional teaching models, the impact of students' exam scores has not changed much. Instead, there has been a slight decrease in the exam scores of the experimental class (which does not exclude the scientific nature of the exam content and the randomness of exam scores).

According to the data analysis in Table 9, in the pre-test, the average score of students with scores below 60 was 58.8 points, with a difference of 1.4 points between the experimental class and the control class. The Z-value was 0.32, indicating that there was no significant difference in the scores between the two classes. However, after introducing online teaching in the experimental class, there was a significant change in the average grades of students with scores below 60. The experimental class was 8.1 points higher than the control class, and the Z-value reached 1.34, showing a significant difference. Specifically, before the experiment, the average scores of students in the two classes with scores below 60 were very similar, with only a difference of 1.4 points and a Z-value of 0.32, which is generally considered statistically insignificant. However, after the experimental class adopted online teaching, the situation underwent significant changes. The average grades of students with scores below 60 have significantly improved in the experimental class, with an increase of 8.1 points compared to the control class. The Z-value of this change has reached 1.34, indicating that the difference between the two classes has become significant. This result suggests that online teaching may have had a positive impact on students scoring below 60, helping them improve their grades.

Generally speaking, students with poor academic performance often have weaker classroom comprehension abilities, and multimedia courseware effectively assists these students in understanding by providing visual and illustrated information. Therefore, after introducing online teaching in the experimental class, the academic performance of students with scores below 60 has significantly improved compared to the control class.

Specifically, the use of multimedia courseware, with its intuitive and vivid characteristics, provides students with poorer grades with richer and easier to understand learning resources. These students may have difficulty keeping up with the pace of traditional teaching due to insufficient comprehension ability, but the multimedia form of online teaching can effectively compensate for this deficiency, helping them better grasp knowledge points and improve their academic performance [12].

Overall, online teaching has achieved good results in the experimental class. However, in terms of individual indicators, the degree of improvement is not consistent. In some aspects, such as classroom interaction and student participation, online teaching has shown significant advantages over traditional teaching [13]. However, in other aspects such as enriching knowledge and conducting in-depth discussions, the effectiveness of online teaching may not be as significant as traditional teaching due to certain limitations. As shown in Table 10.

Table 10. Comparison of score ranges for pre-test and post test between experimental class and control class

		pre-test			**Posttest**		
		80points or above	75-65points or above	60points or above	80points or above	75-65points or above	60points or above
Experimental class	average value	86.7	74.2	58.8	84.3	74.5	59.2
	standard deviation	4.52	9.64	6.23	8.73	4.57	17.32
control class	average value	84.6	71.2	57.4	83.6	73.8	50.1
	standard deviation	4.76	7.89	5.68	7.43	7.01	21.42
z value			0.07	0.32	0.68	0.89	1.34

Although multimedia courseware has many teaching advantages, such as improving teaching efficiency and enhancing students' enthusiasm for learning, modern teaching methods such as online teaching are not omnipotent. [14] If suitable methods and means cannot be found, and the teaching effect is minimal or even inferior to

traditional teaching modes when using multimedia courseware for teaching, it is necessary to repeatedly consider the teaching design, courseware design, and presentation of teaching content to ensure that the teaching is targeted and achieves the expected results. Specifically, although multimedia technology has many advantages in teaching, such as broadening knowledge horizons, improving listening skills, and making teaching content more intuitive and vivid, improper use may also lead to poor teaching effectiveness. For example, neglecting instructional design and simply applying multimedia technology without in-depth consideration of students' learning needs and teaching content may lead to superficial teaching effectiveness [15]. Similarly, if the integration of online and offline teaching is not tight, it may weaken the discourse effect of traditional classrooms, thereby affecting the overall teaching effectiveness.

OVERALL CONCLUSION ANALYSIS

Through the above questionnaire and teaching experiments, it was found that the overall teaching effect in open education is quite significant. Based on the survey and experimental data, as well as feedback from teachers and students, the researchers have drawn the following conclusions:

From the Conclusion of Experimental Data Analysis, It can be Seen That

(1) Online teaching has stimulated students' interest and enthusiasm for learning, improved classroom teaching efficiency, and stimulated students' understanding of knowledge.

(2) In terms of expanding knowledge and inspiring students' thinking in learning, although it is better than traditional teaching, there is no significant difference and the effect is not obvious.

(3) In online teaching, teachers' grasp of the key and difficult points of teaching is not ideal compared to traditional teaching methods, but the effect between the two is not very obvious.

(4) In terms of student performance, online teaching has little impact on the exam scores of open education students, but it has a certain positive effect on students with poor grades.

Based on Feedback from Teachers and Students

From the feedback from teachers and students, it can be seen that while online teaching has shown good results, it is also accompanied by a series of negative effects that are difficult to completely eliminate. These negative effects are caused by various objective and subjective factors, and can only be weakened as much as possible. The advantage of online teaching is that it is not limited by time and space, enriches teaching and learning methods, improves teachers' information technology abilities and the ability to integrate textbooks, and also provides students with a wider range of learning paths and more autonomous learning modes. However, at the same time, online teaching has also exposed some negative effects.

Online teaching has a certain distracting effect on students' attention

The visualized and perceptual characteristics of online teaching means and resources are the advantages of the Internet over the traditional teaching model. However, too much attention to the magnificence of resources in teaching will lead to students' distraction, which will attract students' attention to some music and videos, and the important information of classroom teaching content itself is often ignored. In classroom teaching, although mobilizing students' multiple senses to participate in activities has its advantages, there are also negative effects such as difficulty in meeting the needs of different groups, distracting students' attention, and excessive online unit time information.

Firstly, although mobilizing students' multiple senses to participate in activities can enhance their learning experience and memory effectiveness, due to individual differences among students, this mobilization is difficult to meet the different needs of the entire group. Each student's perception ability, learning style, and interests are not the same, so a unified sensory stimulation method and degree often cannot adapt to all students, resulting in some students being unable to fully participate or feeling uncomfortable.

Secondly, excessive sensory stimulation may objectively distract some students' attention. In classroom teaching, excessive use of sensory stimuli such as visual and auditory stimuli may cause students to become fatigued or distracted, thereby affecting the positive effect of classroom teaching. Especially for students who are easily

distracted or have difficulty concentrating, excessive sensory stimulation may become a disruptive factor in their learning.

In addition, the excessive amount of information presented online per unit time is also a problem in classroom teaching. In classroom collective teaching, due to individual differences among students, some students may receive more information per unit of time than they can handle. A large amount of information leaves students overwhelmed, resulting in limited space for their thinking and inability to fully understand and digest the knowledge they have learned. This situation not only affects students' learning effectiveness, but may also dampen their learning enthusiasm and confidence.

In online teaching, the amount of information presented per unit of time is often too large, which brings confusion to students' learning

Due to individual differences among students in classroom collective teaching, some students find it difficult to digest and absorb such a large amount of information in a short period of time, resulting in them feeling overwhelmed. This information overload not only limits students' thinking space, but also challenges teachers in grasping the key and difficult points of teaching, resulting in students' one-sided or omitted understanding of classroom teaching knowledge. When online teaching presents too much information in a unit of time, some students may feel confused and disoriented due to the inability to process and integrate this information in a timely manner. Their attention may be diverted to different knowledge points, making it difficult for them to focus on the core content and key points. This state of confusion not only affects students' understanding of current knowledge, but may also hinder their mastery of subsequent content.

Lack of corresponding materials in online teaching

The biggest advantage of online teaching is to achieve students' abstract understanding of the knowledge they are learning in the most intuitive way, allowing them to accept the knowledge in a simple and understandable way. One of the biggest bottlenecks in carrying out educational informatization in open education teaching is the lack of multimedia teaching resources corresponding to the open education teaching mode, especially animations, videos, etc. In this experiment, it was also found that animation, video and other resources have very limited channels for obtaining resources, which greatly limits the flexibility of open education online teaching. Even if teaching is conducted through online means, it is only presented in a monotonous way of text and images.

The imperfect network technology itself and the low information technology ability of teachers cause interference in classroom teaching effectiveness.

Due to the limited computer skills of some teachers, they are unable to solve common problems in a timely manner when using online teaching, which leads to the loss of control in classroom teaching and the waste of teaching time

The advantage of online teaching is precisely what offline teaching lacks, and the shortcomings of offline teaching can be improved through online teaching methods. Therefore, combining online and offline teaching to achieve complementary advantages can fully leverage their respective strengths and make up for their shortcomings. By integrating these two teaching methods, better teaching results can be achieved and students' learning experience can be enhanced.

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