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What impact does the use of smart boards in senior high school have on teaching and learning?

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Abstract. Nowadays, with the rapid development of technology, it brings a lot of benefits for the education in China such as the application of smart board.The purpose of the research is analyse the impact of smart board on teaching and learning in senior high school. There are different research ways in it such as questionnaires for both students and teachers and the literature review.Through the project, it finds both advantages and disadvantages of the smart board, but the advantages are more than disadvantages.There are also some problems which needs to improve such as the educational unfairness because in some poor areas, schools can not afford to make all the students use smart board.

Keywords: intelligent, education, smart board, convenient

1. Introduction

The 19th National Congress of the Communist Party of China was held in October 2017, in Beijing. This meeting made a goal of creating 'internet education', it marked a phase when Chinese education would make a great progress, this era is called Educational Informationize . Educational Informationize is innovative promotion by the new generation of information technology with artificial intelligence (AI) at its core. In order to develop Educational Informationize, cultivate a new engine for innovation-driven development in education, Chinese education sector published <Educational Informationize2. 0 Action Plan> in April 2018 (Zheng, 2018). This policy mainly include 8 actions. It must be noted that the third, seventh and eighth actions are new actions that haven't been mentioned in the previous education policies. As a result, these 3 actions are paid more attention by the Chinese education sector [14]. The Action Plan also mentioned that it's necessary to achieve the goal of comprehensive coverage of teaching applications, learning applications and digital campus. To be more specific, the popularization of smart board in schools is one of the product of the Action Plan. The smart board is a comprehensive teaching tool. It not only effectively replaces students' abstract imagination through visualized images to enhance teaching efficiency but also as a mind mapping tool, it can clearly organize subject knowledge. It shows that after this policy was implemented, the internet access rate of primary and secondary schools across Chinese has increased from 25% to 90%. The proportion of multimedia classrooms has increased from less than 40% to 83% [14]. The smart board is also a mark of progress in teaching way from traditional board to AI teaching tool. Chinese education is gradually transforming from being networked and information-based to becoming intelligent and smart. This also shows that the extensive application of artificial intelligence has been the main trend of the times [14]. However, although the smart board can increase the quality and efficiency of teaching, there are still some problems about the smart board such as the frequency of the usage is not very high in some region. In this research, senior high school students are selected as subjects. The main reason for this selection is that the subjects in grades 10-12 are of higher difficulty and depth. As a result, the role of the smart board will become more evident. The thesis aims to study the impacts of teaching and learning after the use of the smart board through the utilization of questionnaires and second-hand research.

2. Literature review

2.1. Smart board's implications for teachers

Nowadays, the smart board has become an irreplaceable teaching tool in the school. In their paper dated 2025, Li stated that mathematics teachers as an example, the biggest challenge that high school students encounter in the subject of mathematics is the ability of spatial thinking. Teachers can give full play to the unique advantages of the smart board. To be more specific, by

leveraging the image transformation function, the smart board can break through the limitations of the two-dimensional space and integrate three-dimensional images and videos into the teaching in a more clear form. Finally, it provides students with a more specific and vivid learning experience. For example, Li who wrote paper in 2025 said that teachers can utilize the functions of smart board to construct a clear space, which can vividly present the connection and patterns between lines, planes and angles through images and videos [5]. Then, students can have a direct understanding of solid geometry and make their concepts clearer. Moreover, the smart board also has teaching resource library. It contains a vast amount of teaching resources, which can be used to update some outdated questions. In this way, smart board can inject new vitality into education. Mind map is also a very important function in the smart board because it can help teachers present abstract content in an intuitive manner. It can also effectively guide students to better organize the knowledge learned in class, assist students in clarifying the learning goals and key knowledge points of the class [12]. Take biology subject as an example, in traditional biological experiments, experimental materials, equipment and sufficient experimental space are required. These materials and equipment may pose safety risks and pose a threat to the health of teachers and students. However, , through the virtual laboratory of the smart board, teachers can effectively avoid these problems [4]. According to Li, this approach greatly enhances the flexibility and safety of teaching.

2.2. Smart board's implications for students

Nowadays, the smart board gradually come into the students' view. The smart board do really provide a great help of students ' studies. According to Li, in 2025, the smart board creates diverse teaching scenarios for students. One the one hand, it enhances students ' interest and motivation in studying, allowing them to actively participate in the exploration of knowledge. On the other hand, by leveraging the function of constructing virtual spaces, it can visualize, dynamicize and concretize mathematical knowledge, enabling students to have a more intuitive understanding of the knowledge concepts and achieving a deeper comprehension of the knowledge. The paper who wrote by Xu in 2024 stated Chinese subject as an example, the poetry studies in senior high school may cover some complex and difficult content. If teachers teach in a traditional way, students may find it boring easily. Over time, this may dampen their interest in learning. However, smart board can perfectly improve this situation because it can create a fun learning environment for students, allowing them to better experience the culture of poetry during learning process. Therefore, it can significantly enhancing the learning efficiency. In the teaching of poetry, the smart board can provide more opportunities for interaction between teachers and students. This is also an effective way for students to learn and understand poetry. Students can communicate about the poetry with each other, conduct group discussions, and create an autonomous, interesting and relaxed learning environment [11]. For the biology experiment, students can observe the experimental process in the virtual environment which create by the smart board. Moreover, students can adjust parameters to explore the impact of different variables on the experimental results. This approach can help students understand the principles of experiment well, it can also significantly increase the learning efficiency.

2.3. Challenges in smart blackboard implementation

However, in some rural areas, smart board have not been popularized completely. Some students in those regions may not accept the way of teaching by using smart board. This may cause the learning atmosphere become weak. However, some teachers merely regarded the smart board as an auxiliary tool for presenting power point. The communication between teachers and students still remained in the form of one question and one answer. Most of the functions of the smart board are put aside and fail to fully realize its core value. By simply using the mouse, the content in the textbook is merely repeated and projected onto the presentation. This teaching method, which is dominated by the content of the presentation, not only deviates from the principles of modern education, but also fails to fully consider the learning patterns and actual needs of students. It is impossible to determine whether students can comprehensively master and digest the content covered in the presentation [7]. Last but not the least, in some schools, their smart board install AP internet module which included one WAN interface and three LAN interface. However, because of this configuration, some classes say that the smart board connection to the internet is very unstable. Sometimes it can access the internet, but other times it cannot connect to it for even several days [3].

2.4. Research gap

Existing studies mainly focus on single subjects, with limited research on cross-subject teaching effectiveness and student support. Since students learn multiple subjects and classroom smart boards support various disciplines, a comprehensive research approach is necessary. This paper explores the dual impact of smart boards on both teachers and students, aiming to provide practical insights for future development. The study covers multiple subjects to offer useful references for educators and learners.

3. Methodology

In order to get the target of the research, A questionnaire for students and teachers was used to collect primary data. In addition, literature was collected as secondary data.

3.1. Secondary research

This research includes a comprehensive literature search from June 2025 to August 2025. All dissertations were conducted on CNKI around the following keywords, Seewo smart board, senior high school education, Education Informatization 2. 0 Action, etc.

First, control for the selected articles to be in a narrow frame between 2020-2025. The following reasons can be taken into consideration. First, these sources were all published within the last 10 years in order to make sure the information reflects the most recent improvement and advancements of smart board. Secondly, the technology of smart board is not yet mature before 2020 because smart boards were not widely popularized in Chinese schools at that time. As a result, it is not very accurate to choose literatures before 2020. However, several studies from 2018 were also selected for this essay, since they introduced the background of smart board in Chinese. One of the most important thing is the policy called Education Informatization 2. 0 Action was implemented by the Chinese education sector in April 2018. This policy explain the reason why smart board is accepted by Chinese schools and then be popularized after that. As a result, this part of the literature was eventually referred to as well.

3.2. Primary research

Then, during the analysis, It sets two groups of results, one for teachers and another for students. The reason for this is because the purpose of the study is the analysis the teaching and learning in school by using the smart board, so it is necessary 9to conduct the research from both the perspective of students and that of teachers.

In order to study the use effect of smart board, the real feedback of the users and how it was used, these data are indispensable. Therefore, it is vital to make questionnaires for both students and teachers, which can collect enough opinions and attitudes for the smart board in order to analysis the effect of it. As the subjects in grade 10-12 are of higher difficulty and depth, the role of smart board will be more highlight. Therefore, the senior high school students and teachers are the main subjects of this research.

In teachers' questionnaire, it consist 14 questions. The problem setting was mainly based on several aspects, first was based on the basic information of teachers such as work experience, the subjects they teach and the popularizing rate of smart board in their schools. Secondly, it was based on the usage situation of smart board such as the difficulty they meet when using the smart board, the most popular functions of smart board. Last but not the least, it was based on the respondents ' feedback and suggestions on the effect of smart board. The final sample size of the questionnaire was 30 and all the 30 were completely filled in. In students ' questionnaire, it consist 18 questions. The problem setting was mainly based on several aspects, first was based on the location of home address of students such as rural areas and county. Secondly was also based on the usage of smart board in the school such as the frequency of using smart board from Monday to Friday, the difficulty the students meet when using smart board. Thirdly, it was based on the advice and feedback of students. The final sample size of the questionnaire was 81 and all the 81 were completely filled in.

4. Result

The following results were obtained from the questionnaires completed by both students and teachers. The analysis is divided into two main perspectives: students' responses and teachers' responses. A comparison between the two groups would also be provided to highlight similarities and differences.

4.1. Students

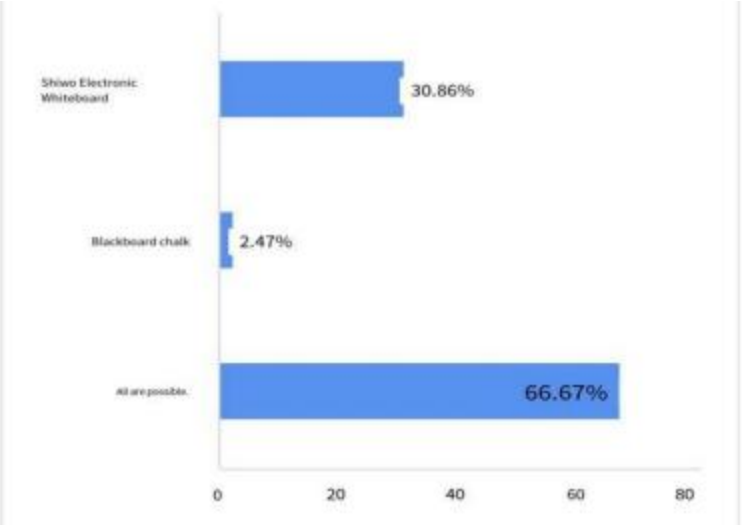

Figure 1. What teaching methods do you like your teachers to use

This graph shows the answers made by students, most of them like the combination of the blackboard and the smart board. It accounts the vast majority of the diagram (73. 68%) This data indicate that it is common to see the combination of blackboard with the smart board.

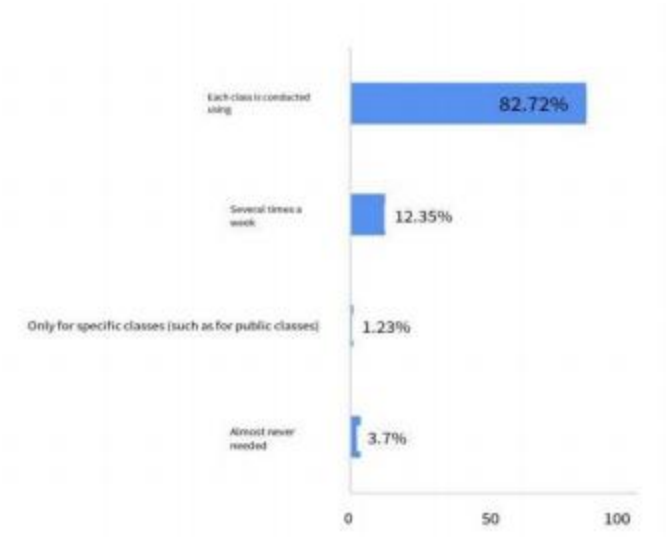

Figure 2. The frequency of using smart board

The chart is answered by students. It displays that almost all the students are using the smart board in their daily life. Smart board has become a necessity teaching tool in the school.

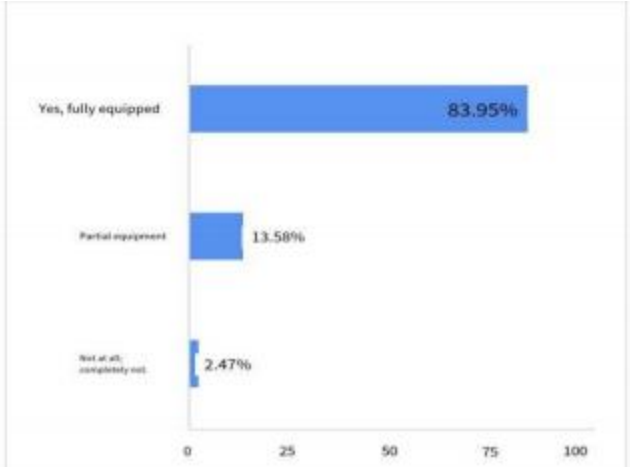

Figure 3. The popularizing rate of smart board

The graph shows the popularizing rate of the smart board in school. Above 80% of schools has intact system of smart board. However, there are still about 2% of schools that do not have ability to use smart board smoothly.

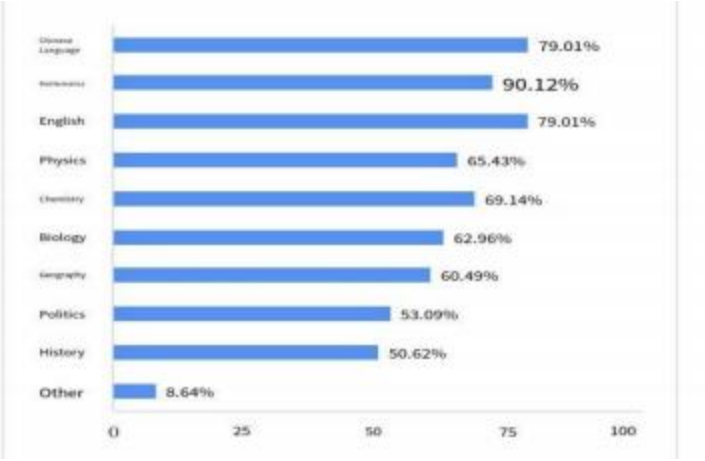

Figure 4. Smart boards and different subjects

The diagram shows the frequency of using smart board in different subjects. It shows the maths is the most frequently subject that use the smart board (90. 12%), but other subjects are also necessary to use smart board. Moreover, their usage frequency is very similar with each other. (about 50%--70%)

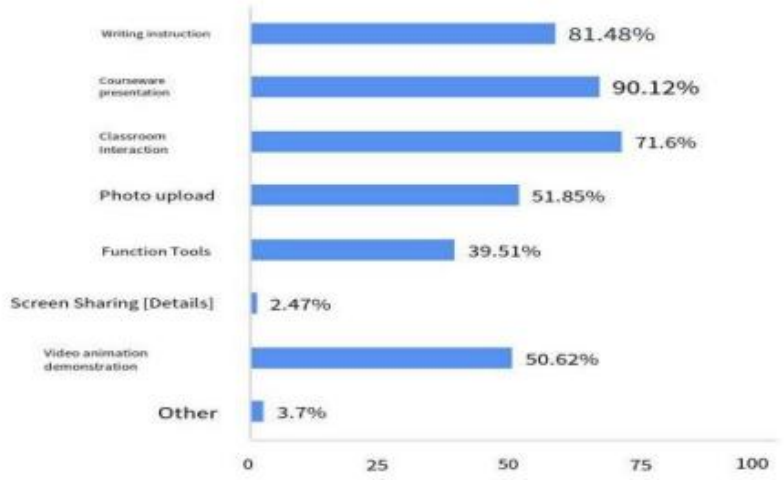

Figure 5. The functions of smart board

The diagram shows the functions of smart board that students consider teachers will use in the school. The results show that the most popular function of smart board is power point presentation (about 90. 12%). Moreover, other functions such as writing instruction is also be used frequently. Their usage frequencies are very close to each other except screen sharing. It is the lowest frequency that be used.

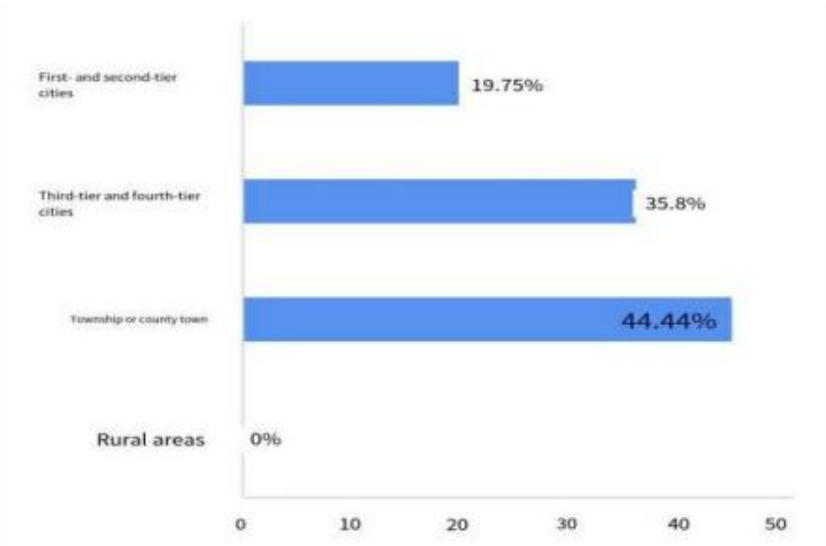

Figure 6. The regions which students live in

It shows that most of the interviewees are live in townships and county cities (about 80%). there are only a few part of people live in modern cities. However, there are none of people who live in the rural areas.

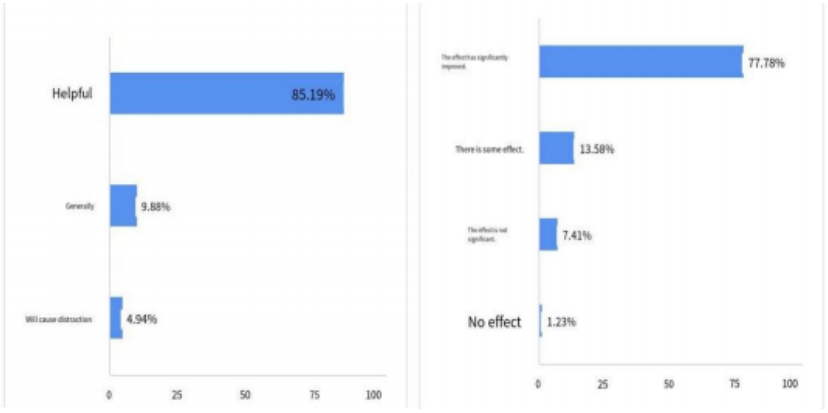

Figure 7. The opinions of students about smart board

It shows the opinions of students about the smart boards and make these graphs. It can be concluded that most of the people agree that smart board can be helpful for their studying and working and the affect is very large and important. However, some students also consider that smart boards can make them be careless in their study. (about 5%)

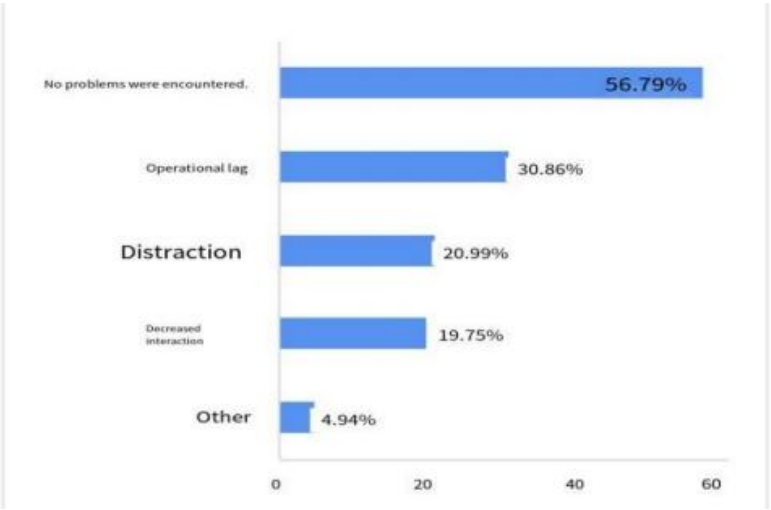

Figure 8. The difficulties students meet when using smart board

From the graph, it can be concluded that the most common problem of smart board is the delay of equipment. However, most of students still think there are no problems of smart board. That is a good feedback.

4.2. Teachers

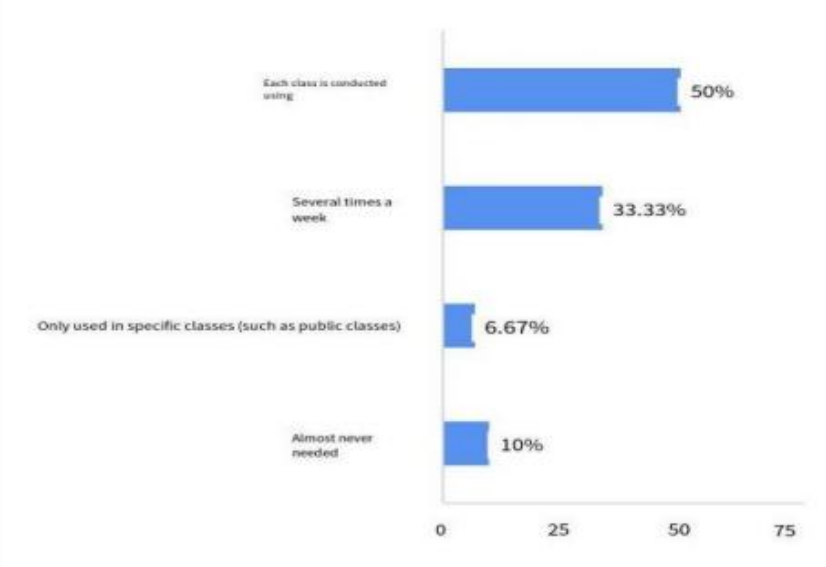

Figure 9. The frequency of using smart board

The graph displays the frequency of the teachers who use smart board. From the diagram, it can see that half of them (50%) use the smart board every day, but there are still another half of them who only use it several time a week or even never need to use it.

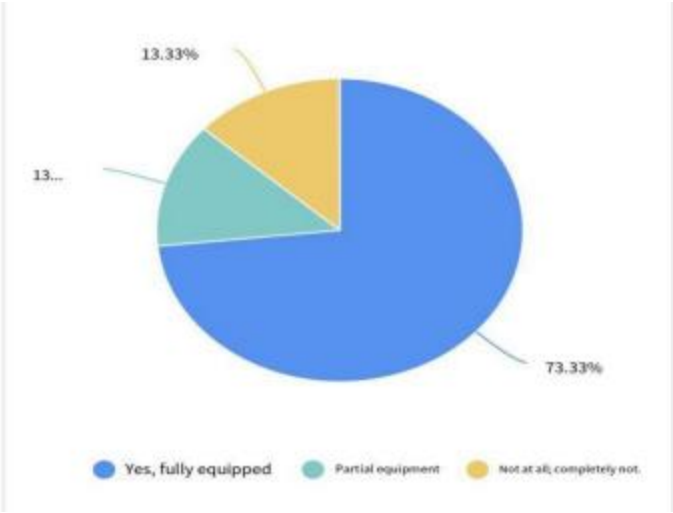

Figure 10. The popularizing rate ofsmart board

The diagram shows the rate of popularization of smart board, the data is from teachers who in the Chinese schools. It can be concluded that about 86% of schools have install smart board. 73% of them have intact smart board system. However, there are still 13% of schools that do not have smart board. This small gap indicates that while there has been significant progress in the adoption of smart boards, some schools still face barriers, likely due to regional or economic disparities.

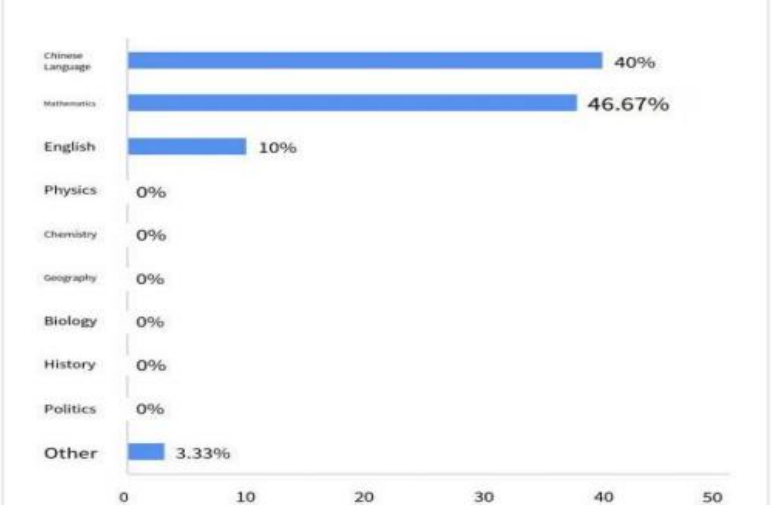

Figure 11. Smart boards and different subjects

The diagram shows what subjects do the teachers who answer the questionnaire teach. It can see that most of them are teaching maths and Chinese. The number of people who teach math is the largest (46. 67%). However, the teachers who answer the questionnaire only teach Chinese, math and English. None of them teach others.

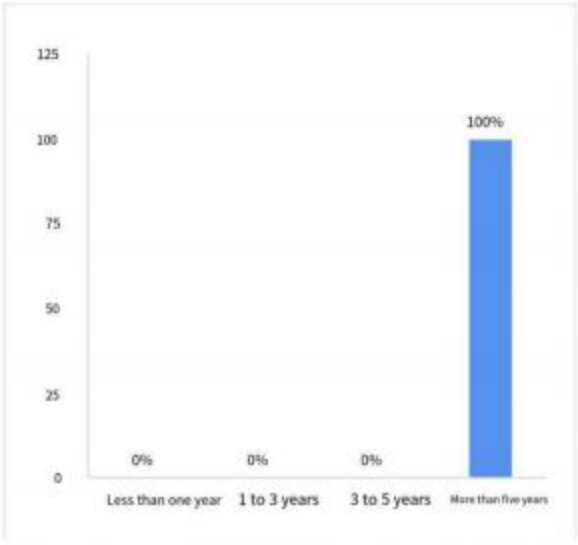

Figure 12. The teaching experience ofteachers

This graph shows the teaching experience of teachers who answer the questionnaire. All the 30 teachers have at least 5 teaching years. It make sure that my first-hand research is authoritative.

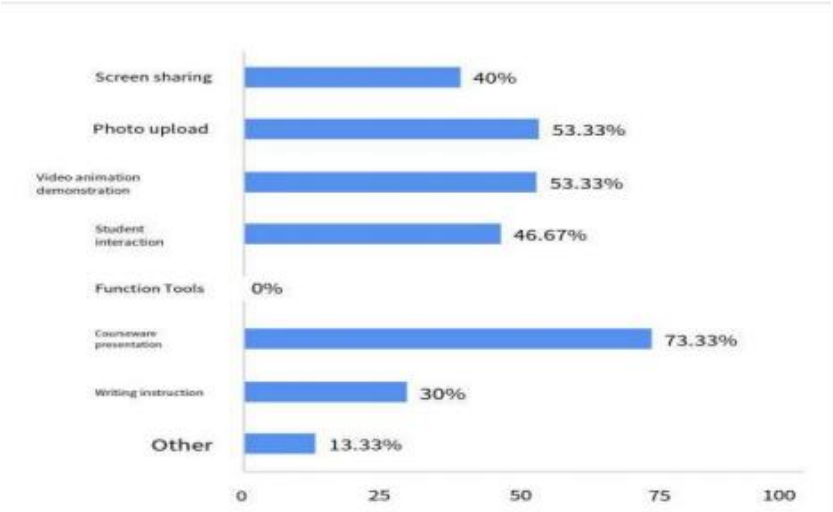

Figure 13. The functions ofsmart board

The diagram shows the functions teachers use in the smart board. The most popular function is 'courseware presentation' (about 73%). The frequency of other functions are very similar except 'function tool', that means most of functions are very useful for teachers.

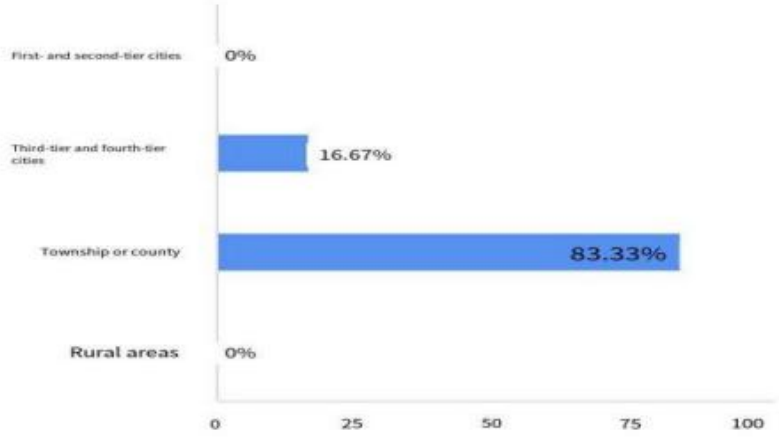

Figure 14. The regions which teachers live in

It can be concluded that most of them are live in county city (83. 33%). There are none of teachers live in modern cities and rural areas. This geographic distribution may influence the results, as schools in rural areas or economically disadvantaged regions might not have access to the same educational resources, including smart boards. This could affect the generalization of the findings.

Figure 15. The opinions ofteachers about smart board

The diagram can be concluded that most of teachers think smart board are very helpful for their work and teaching. About 93% of them consider smart board can increase the interaction and communication with students.

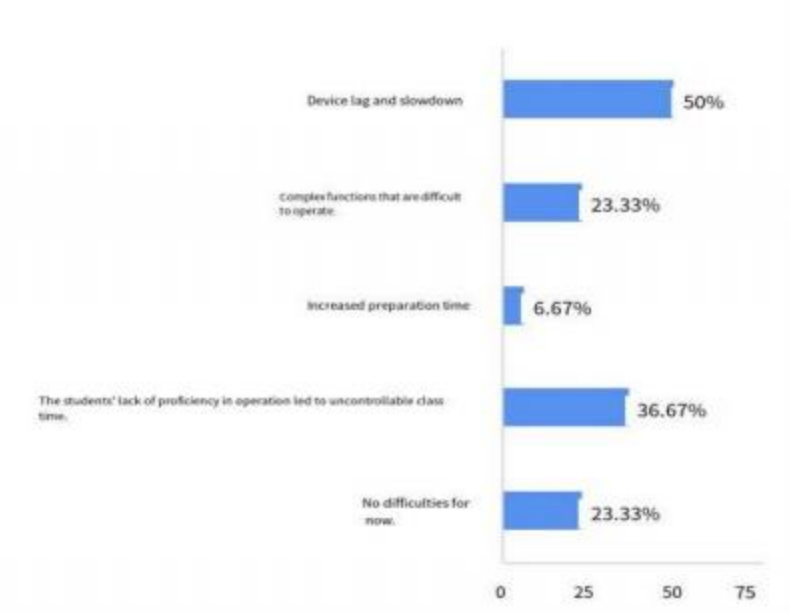

Figure 16. The difficulties teachers meet when using smart board

From the graph, it can be concluded that the common problem of smart board is the delay of equipment because half of them agree with it. Only about 23% of teachers have no difficulties with the smart board, that means most of teachers still think the smart board are difficult to use.

Comparison between students and teachers

In both of the students and teachers ' questionnaire, it easily see that the popularization rate of smart board are between 70%---80%, although it is very high, there are still a small part of schools which can not be able to use smart board. Also, both of them think that smart board can increase the quality of study and teaching, that means smart board do provide a positive effect on students and teachers. Moreover, it can see that both of them meet the same problem when using the smart board---the unstable internet. Last but not the least, the most common function is the presentation. Both students and teachers agree with that.

5. Discussion

5.1. Teachers' perspective

The survey covers aspects such as teaching experience distribution, school regional characteristics, equipment availability, subject background, usage frequency, function preferences, teaching assistance effectiveness, and actual difficulties. This provides a preliminary basis for further in-depth exploration of the application optimization of smart board in teaching.

From the data based on the diagram 7, it shows that most teachers who doing the questionnaire are lived in county cities and townships. There are none part of teachers who live in modern cities. This may have some bad effects on my research because the data is not very comprehensive. In previous literature they didn't mention their background and schools conditions. This may increase the uncertainty of their conclusions. In diagram 2, it shows that most teachers have been used to teaching with the smart board in their daily life. It mainly because of the support of educational sector and local government. Both of them provide a great help of popularization of smart board. It's the same finding as the Fen and Ren's paper in 2018, most Chinese schools do really have started using internet to doing education. Then in the diagram 3, it can be concluded that most of the schools have intact smart board facilities. However, there are still 13. 33% schools which teachers work at do not have smart board completely. That may because those regions are rural areas, the economic in those places is not very strong. As a result, local government can not have ability to afford popularizing the smart board in schools. The cost of smart board may be too high for them. However, in Fen&Ren's paper in 2018, it stated that the proportion of multimedia classrooms has increased from less than 40% to 83%, in my secondary data, it only has 73. 33% schools who have multimedia classrooms. The reason may because the teachers who answer the questionnaire are all from county cities and townships. As a result, the data is not very accurate. The teachers who live in modern cities are not included in the statistics. In diagram 4, mainly half of the teachers are teaching maths. It can be proved that the usage of smart board in maths subject are more popular than other subjects. The reason for that is the special functions in the smart board. To be more specific, maths teachers can use smart board to make some abstract geometric models be more clear and easy to understand. Students can watch images and videos which provided by smart board in order to

learn the knowledge. It's the same situation as Li's paper which writing in 2025, maths is very rely on the smart board. In diagram 5, it stated some common functions that teachers use during teaching. It shows that the frequency of the function of 'courseware presentation ' is far higher than other functions such as'screen sharing' . The other functions shares similar trend except 'function tool', it's different from Liu's paper which in 2018. In that paper, it says that function tool is very useful for maths teachers. I think the main reason for the result is because the teachers do not understand how to use the function tool. Anyway, a lot of functions in the smart board are extremely necessary and useful. The teachers will use almost all the functions in their teaching work. This prove that smart board do really provide a great help of improving the effectiveness of teaching. In diagram 8, it specifically show the advantages and help of smart board which teachers consider. Some of them think that smart board can activate the classroom atmosphere, improve teaching efficiency and enhance interactivity and participation with students. It's the same findings as the previous essays.

5.2. Student's perspective

In the discussion part, it will explore the current application status of smart board in high school teaching. The questionnaire covered aspects such as the distribution of school areas, the availability of smart board, usage frequency, students' preferences, teaching impacts, and common problems. It comprehensively analyzed students' acceptance and effectiveness of this technology. From the data based on diagram 7, most of the students are also live in the county cites. There are none of students live in rural areas and only a few live in modern cities. This may has a little bad effect on the research. In diagram 1, it can see that the students who like studying with the combination of blackboard and smart board accounts the majority of the graph. This perfectly conform to the current situation of the classroom equipment. Nowadays, the mainstream teaching equipment in the school is the combination of the blackboard and smart board because it has significantly increased the space available for the teachers to take notes. It also conform to the teachers' questionnaire trend. In the diagram 2, it can see that almost all the students are learning with the help of smart board in the school, that means smart board has become an irreplaceable studying tool. This is supported by the implement of policy , the government and school spend money on buying these facilities. With these help, in diagram 3, it can see that only a few part of students are not able to use smart board. The total students who can use smart board to study are more than 90%. Since the students who live in modern cities and rural areas are not fully included, the actual data may fluctuate within a certain range. In the diagram 4, it can be concluded that all the subjects in senior high school are need smart board to study. The subject that uses the smart board most frequently is mathematics. It may because most maths knowledge are very hard for senior school students to understand. The smart board can provide clear imagines and videos for students to learn. In this way, the smart board do improve the studying efficiency of students. It's the same conclusions as the Li and Liu's paper. Other subjects also need the help with smart board, maybe the teachers will take notes on it or explain some difficult questions by using special tools on the smart board. Then in diagram 5, it states some functions that students use when studying by smart board. The 'courseware presentation ' function is also the most popular in students ' questionnaire. Moreover, other functions the students will also use sometimes. It prove that the functions of smart board are very rich and useful. The smart board highly improve the quality of education with the help of these tools and functions. In the diagram 8, it can see that most students think smart board can be helpful for their study. The effect of studying has significantly improved by the it.

5.3. The main problems of the smart board

In the students ' questionnaire, there are about 30% of them think that the internet is not very stable when using the smart board since the special configuration in the smart board. It's the same situation as the Kong and Huang's paper. Some students also agree that the smart board can lead them to be distracted with the study. The main reason is because that in the smart board, the students can download some entertainment software such as TikTok. They may watch short videos during the self study time if there are no teachers in the classroom. In the previous literature, few papers mention this point. In the teachers ' questionnaire, there are half of them also consider that the internet is unstable. It proved that at present time, the smart board delay is the main problem of the smart. Some of them also think the smart board is too complex to use during teaching. The main reason may because the functions in the smart board are very rich. Moreover, there are no tips of functions so that some teachers can't understand how to use them. Also, some teachers find that if students are not skilled in doing questions on the smart blackboard, the progress of class may be slow down.

5.4. Some advice about applying smart board

Since students and teachers have to watch the smart board all day long, it is very harmful for their eyes. As a result, the smart board can add'eye-protection mode' in order to decrease the damage to the eyes caused by screens. For example, the smart board can automatically adjust brightness and color temperature. Therefore, it is more comfortable for students and teachers to watch.

Secondly, related departments can upgrade software and hardware of the smart board to increase the stability of the server. In this way, it can reduce the risk of equipment failure.

Thirdly, the developer of the smart board can make some videos about how to use the different functions of the smart board. As a result, teachers and students can learn these functions well and use it more smoothly.

Fourthly, the smart board can add 'focus mode ' in order to hide redundant information and applications. In this way, it can effectively avoid students downloading some entertainment applications or even playing video games on the smart board.

Fifth, the relevant departments can apply for donations to install smart blackboards in those impoverished schools, thereby it will enhance the fairness of education. The Chinese education will develop more quickly.

Moreover, the developers can try to use cheaper materials to assemble the smart board so that the cost of smart board will decrease. Some schools which in the poor areas like rural areas can afford to let their teachers and students use smart board. As a results, the popularization rate of smart board will soon increase rapidly.

6. Evaluation

The essay has its strengths. It provides both students ' and teachers ' attitudes about the smart board. To be more specific, it clearly explains the effect which provided by the smart board on the learning and teaching instead of only paying attention on one aspect. This essay include both students and teachers data, the collection is comprehensive. Moreover, it cited literature from

CNKI, so that it insure the authority of the essay. Also, the collection of data are all from the senior high school students. It make sure the results are accurate and precise.

However, it also has some drawbacks. First, the quantity of the teachers ' questionnaire is not enough. It is much smaller than the quantity of the students ' questionnaire. This may cause that some other teachers ' suggestions can not be included in the essay. The result may not be very accurate. Secondly, most of the students and teachers are in the county cities, none of them are from rural areas. As a result, this may also affect the result of the research. To be more specific, if the region which teachers and students live in are similar, that may be difficult to show the unfair level of education and difference between the rich areas and poor areas. In the future, it can do further research on this problem. Last but not the least, almost all the cite of the literature are from CNKI, that may cause the data monotonous. It need to be collected from more websites.

7. Conclusion

The aim of the research is analysis the impact of using smart board on the learning and teaching in senior high school and provide suggestion based on the research result. The main method in this study is primary research and secondary research which can obtain information from previous literature and questionnaire. The results show that smart board do really give a great help of students and teachers on their work by using a lot of functions in it such as constructing a virtual space. These functions can help students make a clear concept of knowledge especially for those math knowledge. It is more convenient for teachers to use these functions.

As an advanced and new teaching tool, the invention of smart board do really make a great progress of Chinese education. However, it also has some drawbacks that need to be improved such as the unstable internet and the expensive cost. If these problems can be corrected, the smart board will become more perfect.

In the future, the further research need to do on the aspect of unfair education on different regions because nowadays there are still some students and teachers which can not use smart board in the school. The government should give more support on the installing of smart board then it can improve the fairness of education.

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