Construction of Smart Campus in Primary and Secondary Schools Based on Teachers' Needs

Taking the Dongcheng District of Beijing as an Example

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Abstract. Smart campus is a crucial task for the informatization and modernization of education. The construction of smart campus is supported by multiple intelligence technologies such as information technology and computer technology, and the media literacy of teachers is also the guarantee for the effective application of smart campus. To better realize "educational modernization" in Dongcheng District, Beijing, in order to better build a smart campus. Research use "Media Literacy Assessment Scale (Simplified Version)" developed by Li Jincheng. A survey was conducted on the status of media literacy among 1810 teachers. At the same time, the demand of teachers in the construction of smart campus is investigated. The survey consists of a self-compiled questionnaire with ten questions covering four dimensions: teaching, educational administration and logistics support, and intelligent office. KMO = 0.859, Cronbach's Alpha = 0.865.It shows that the scale has good reliability and validity. The study found that, an investigation of teachers' media literacy reveals that the overall level of teachers' media literacy is relatively high and that there are no significant differences between teachers of different genders, educational backgrounds, or ages. Teachers have a strong desire for smart campus buildings, according to an examination of their needs for smart campuses. Teaching, educational administration and logistical support, and intelligent office are the dimensions in which demand is greatest to least.

Keywords: smart campus · basic education · teacher demands · construction · Dongcheng District · Beijing

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1 Research Background

In order to implement education informatization and education modernization, smart campuses play a crucial role. It combines advanced computer technology, communication technology, 5G technology, big data technology, Internet of Things technology, and education in order to realize intelligent campus management and enhance teaching quality, thus encouraging the reform and innovation of teaching methods in primary and secondary schools [1].

2020 saw the formulation of the "Three-Year Development Plan for Smart Education in Dongcheng District, Beijing (2020–2022)" by the Dongcheng District People's Government. It aims to assist Dongcheng District in achieving its goal to "accelerate the modernization of education and build an education modernization demonstration zone with Dongcheng characteristics, capital city standards, Chinese characteristics, and world-class standards."

This study explores the needs of teachers in the establishment of smart campuses based on the actual situation in the Dongcheng District, providing effective data support for the development of smart education systems. In the meantime, a survey was also done regarding teachers' actual media literacy.

2 Literature Review

It is challenging to do research on the design of a smart campus since it involves a vast system, intricate content, and several technologies. [2–5] There are currently extensive studies on smart campuses, which are crucial to the development of smart campus construction in a sustainable manner. With the rapid development of the social economy, the advancement of information technology, and the innovation of education and teaching models, the existing research results are insufficient, particularly with regard to the specific problems that exist in actual construction, their solutions, and their strategies. [6–15] To further improve the development and application of educational information technology and to lead and support the construction of "smart campuses" in elementary and secondary schools [16–19], existing research needs to be optimized.

The study examines the desire for smart campus buildings among primary and secondary school teachers in Beijing's Dongcheng District, providing a foundation for the general improvement of smart campus construction.

3 Research Methods, Research Tools and Research Samples

The research primarily employs the approaches of literature analysis and the questionnaire survey. The current demands of smart campus buildings in primary and secondary schools in Dongcheng District are discussed and analyzed, as measures for developing teachers' media literacy.

3.1 Research Methods

1) Literature Analysis
This method relies mostly on CNKI, Google Scholar, etc. for literature, understanding the present research status of smart campuses at home and abroad, and mastering the most cutting-edge theoretical research in order to serve as a guide for this research.

2) Questionnaire Survey
Using questionnaires, a survey was done on the media literacy of elementary and secondary school teachers and the requirements for smart campus development. The statistics and analysis of the questionnaire survey data were investigated and integrated to offer data support for the development of countermeasures and a foundation suitable for the construction of smart campuses. The questionnaire consists of two sections. The first section is a study of teachers' media literacy, while the second section discusses instructors' requirements for smart education campuses.

3.2 Research Tools

1) Media Literacy of Teachers
The first section of the survey consists of ten questions based on the "Media Literacy Assessment Scale (Simplified Version)" developed by Li Jincheng. The scale's total Cronbach's alpha is 0.864. Cronbach's alphas for the five dimensions of assessment, evaluation, participation, communication, and composition are 0.795, 0.815, 0.832, 0.803, and 0.728, respectively, showing that the scale's reliability is good, where reliable and consistent findings may be achieved. Then, the adaptability analysis of the factor model revealed that the KMO value was 0.86, passing Bartlett's test with a significance level of 0.05, indicating that this scale was appropriate for factor analysis. The cumulative variance contribution rate of the factors, which stands at 61.874%, demonstrates that the factors that can be extracted from each item are consistent with the theoretical assumptions. The orthogonal rotation method converged after 6 iterations, and loads of each item on the corresponding factors were greater than 0.7, indicating that the scale has good validity. The questionnaire employs a 5-point Likert scale, where "1" refers to "highly inconsistent/infrequent," "2" refers to "somewhat inconsistent/infrequent," "3" refers to "not sure," and "4" equates to "somewhat consistent/frequent." The higher the score, the more accurately the factor is represented.

2) Teachers'Needs for Smart Campus Construction
The second section of the survey consists of a self-compiled questionnaire with ten questions covering four dimensions: teaching, educational administration and logistics support, and intelligent office. The questionnaire's reliability and validity were examined, and the results were analyzed using SPSS statistical software. The objective of the item discrimination analysis is to determine the critical ratios of the questionnaire's individual items. By sorting based on total score, the author splits the high-end 27% and low-end 27% into two groups and analyzes the difference in scores on each item between the two groups. The differences between the 10 examined items were statistically significant. KMO and Bartlett's Test of Sphericity are used to determine the KMO for ten items, where KMO = 0.859. Kaiser considers a range of $0.8 < \text{KMO} < 0.9$ to be adequate for

Table 1. Sample Size Statistics (Own Draw)

	Item	Scale%
Sexuality	Male	18.62
	Femininity	81.38
Age	Under the age of 31	18.95
	The ages of 31 and 40	34.25
	The ages of 41 and 50	34.25
	Aged 51 or above according	12.54
Educational background	Undergraduates	80.77
	Postgraduates (including masters and doctors)	18.12
	rest	1.10

factor analysis. The X2 score of Bartlett's test for this questionnaire was 1269.903, p0.01, reaching a significant level, indicating that the overall correlation matrix is suitable for factor analysis because it contains common factors. Cronbach's alpha is 0.865 based on the analysis of the questionnaire, whereas it is 0.869 based on standardized items. According to the value range of Cronbach's coefficient, a score between 0.8 and 0.9 is acceptable. The questionnaire employs a 5-point Likert scale, with "1" representing "very little need," "2" representing "somewhat needless," "3" representing "not sure," "4" representing "pretty needy," and "5" representing "very much needed." The greater the score, the greater the item's demand.

3.3 Research Samples

There was a total of 1,810 valid samples taken, including 337 men and 1,473 females based on gender; 343 individuals under the age of 31, 620 individuals between the ages of 31 and 40, 620 individuals between the ages of 41 and 50, and 620 individuals aged 51 or above according to age group. In terms of educational background, there are 1,462 undergraduates and 328 postgraduates (including masters and doctors). Details can be found in "Table 1 Sample Size Statistics". The proportion of the research sample matches the proportion of the overall sample of actual teachers in Dongcheng, Beijing, which is, to some extent, representative.

4 Research Results and Analysis

4.1 Analysis of Media Literacy Among Primary and Middle School Teachers in Dongcheng District, Beijing

A total of 1,810 valid samples were collected. This section will analyze media literacy among teachers. See "Table 2 Descriptive Data of Teachers' Media Literacy Ratio" for the ratio of teachers who are media literate. 49.78% of teachers selected "very consistent"

for the statement “able to obtain sufficient media knowledge for life, study, and employment”. 49.12% of the teachers selected “very consistent” for their ability to “constantly upgrade their information acquisition skills”. In terms of “skillfully using software tools for information retrieval”, 47.85 percent of teachers selected “very consistent”. As to “the ability to evaluate the potential impact of media information content on others or society,” 46.19% of teachers opted for “very consistent”. When it comes to “judging the credibility of information based on the authority of the information publisher”, 47.90% of teachers selected “very consistent”. 39.39% of teachers selected "very suitable" as “capable of converting and compressing audio and video content”. 39.39% of teachers chose “very suitable” for “capable of format conversion, compression, and enhancement of image materials”. Regarding “capable of synthesizing and publishing multimedia”, 35.25 percent of teachers selected “very consistent”. Concerning “the frequency with which they participate in the discussion of social events via the Internet”, 32.76 percent of teachers selected “very infrequently”. For “expressing personal dynamics and opinions over the Internet”, 31.44 percent of teachers selected “very infrequently”.

According to the matrix average analysis, the average score for teachers’ media use is 3.82, while the average score for their frequency of use is 2.31. The overall average score for the 10 questions is 3.52, showing that teachers’ media literacy is relatively strong.

Table 2. Descriptive Data of Teachers’ Media Literacy Ratio (Own Draw)

Item	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Mean
Able to obtain sufficient media knowledge for life, study, and employment	5.25	5.97	8.01	49.78	30.99	3.95
Constantly upgrade their information acquisition skills	4.86	6.57	8.73	49.12	30.72	3.94
Skillfully using software tools for information retrieval	5.14	7.07	12.32	47.85	27.62	3.86
The ability to evaluate the potential impact of media information content on others or society	4.92	6.19	12.65	46.19	30.06	3.90
Judging the credibility of information based on the authority of the information publisher	4.03	5.14	12.43	47.90	30.50	3.96
Capable of converting and compressing audio and video content	5.52	9.28	17.73	28.07	39.39	3.75
Capable of format conversion, compression, and enhancement of image materials	5.69	10.28	18.67	25.97	39.39	3.70
Capable of synthesizing and publishing multimedia	7.35	12.82	23.7	20.88	35.25	3.50
The frequency with which they participate in the discussion of social events via the Internet	32.76	28.01	19.67	13.98	5.58	2.32
Expressing personal dynamics and opinions over the Internet	31.44	30.99	20.00	12.38	5.19	2.29

Additional examination of differences in gender, age, and educational background is conducted where $P > 0.05$ indicates that the difference is not statistically significant. It demonstrates that there is no difference in the overall media literacy of teachers.

4.2 Teachers' Needs and Analysis of Smart Campus Construction

There was a total of 1,810 valid samples gathered, and this section assesses the demand for smart education platforms among teachers. See "Table 3 Descriptive proportion statistics table for teachers' demand for smart campus construction" for descriptive proportion statistics on the demand for smart campus construction among teachers. In terms of "demand for the use of the school's intelligent office system", 81.94 percent of teachers indicated a requirement (including "relatively need" and "very need"). Regarding "needs for school intelligent educational administration (enrollment information, class schedule arrangements, examination information, results release, etc.)", 79.17% of respondents selected "need" (including "relatively need" and "very need"). 82.04% of instructors chose to have a need for "intelligent school services and support for students' personalized learning" (including "relatively need" and "very need"). 81.38% of instructors selected "need" on "needs for schools' intelligent service for precise teaching supported by big data" (including "relatively need" and "very need") as their response. 78.84% of teachers chose "need" (including "relatively need" and "very need") for "the demand for school-based intelligent classroom teaching to cover all subjects and related evaluation". As to "needs for intelligent classroom technology support and training," 81.93% of instructors (including "relatively need" and "very need") reported having a need. 79.67% of the teachers selected "need" (including "relatively need" and "very need") for "the desire for the school's intelligent remote teaching to cover all subjects and related evaluation". On the "need for school intelligent service of marking and score analysis," 83.70% of teachers indicate a need (including "relatively need" and "very need"). In terms of the "need for intelligent services in school libraries, clinics, canteens, and other departments", 80.78 percent of instructors selected "need" (including "relatively need" and "very need") as their response. 80.05 percent of instructors chose "needs for school intelligent service, management, and related evaluation" (including "relatively need" and "very need").

The analysis of the matrix mean reveals an overall average score of 4.06, indicating that instructors have a high need for the building and use of smart campuses. The average scores for each dimension are as follows: teaching, educational administration and logistics support, and intelligent office, with scores of 4.07, 4.06, 4.06, and 4.02, respectively.

The top three demands, ranked according to the average score of each project, are "demand for school intelligent service of marking and score analysis," "demand for school intelligent service and support for students' personalized learning," and "needs for schools' intelligent service for precise teaching supported by big data," with respective average scores of 4.12, 4.09, and 4.12. The top three needs are all related to teaching. Additional studies are carried out on differences in gender, age, and educational background, where $P > 0.05$ implies that the difference is not statistically significant.

Table 3. Descriptive proportion statistics table for teachers' demand for smart campus construction (Own Draw)

Item	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Mean
Demand for the use of the school's intelligent office system	0.77	3.70	13.59	53.04	28.90	4.06
Needs for school intelligent educational administration (enrollment information, class schedule arrangements, examination information, results release, etc.)	1.44	4.42	14.97	48.62	30.55	4.02
Intelligent school services and support for students' personalized learning	0.83	3.04	14.09	50.66	31.38	4.09
Needs for schools' intelligent service for precise teaching supported by big data	0.72	2.93	14.97	49.06	32.32	4.09
The demand for school-based intelligent classroom teaching to cover all subjects and related evaluation	0.66	3.92	16.57	52.6	26.24	4.00
Needs for intelligent classroom technology support and training	0.72	3.43	13.92	53.48	28.45	4.06
The desire for the school's intelligent remote teaching to cover all subjects and related evaluation	0.77	3.87	15.69	52.76	26.91	4.01
Need for school intelligent service of marking and score analysis	0.77	2.93	12.60	51.05	32.65	4.12
Need for intelligent services in school libraries, clinics, canteens, and other departments	0.66	3.81	14.75	49.12	31.66	4.07
Needs for school intelligent service, management, and related evaluation	0.61	3.48	15.86	50.33	29.72	4.05

5 Overall Architecture Model of Smart Campus Construction

From digital campus to smart campus, we need to integrate new service concepts, comprehensive management business and information sharing mechanism, optimize the process and improve the management level. Based on the functional application requirements and design principles of smart campus, the overall construction idea of smart campus is shown in "Fig. 1 Overall Construction Model of Smart Campus".

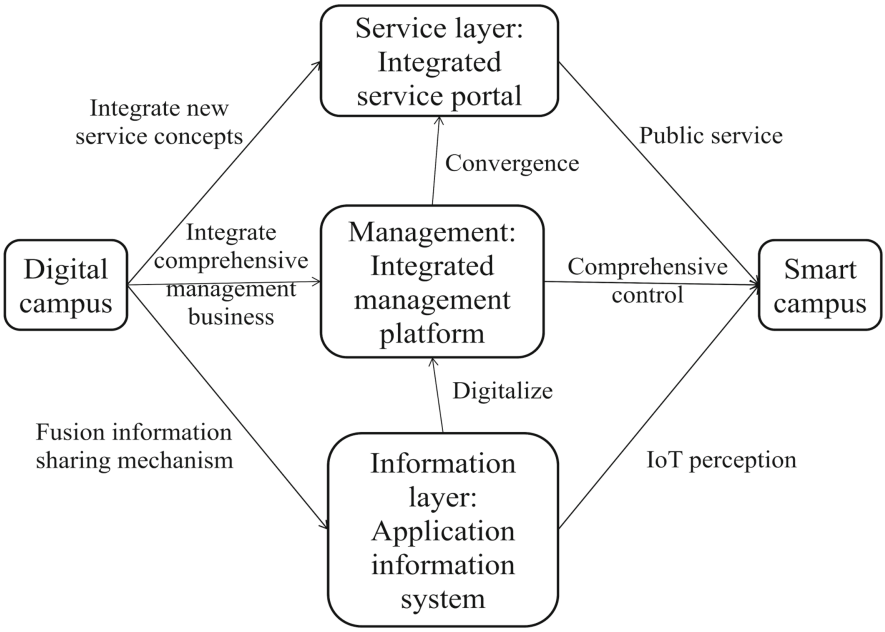

Fig. 1. Overall Construction Model of Smart Campus (Own Draw)

Based on the planning and construction model of smart campus in many domestic schools, the overall architecture of smart campus construction is studied and designed. See "Fig. 2 Overall Architecture Model of Smart Campus Construction" for details. The model is divided into five layers from bottom to top, namely, perception layer, network layer, data layer, application layer and service layer, supplemented by two guarantee systems, namely, information standard and specification system, operation maintenance and security system, to ensure the standard construction and operation maintenance of smart campus.

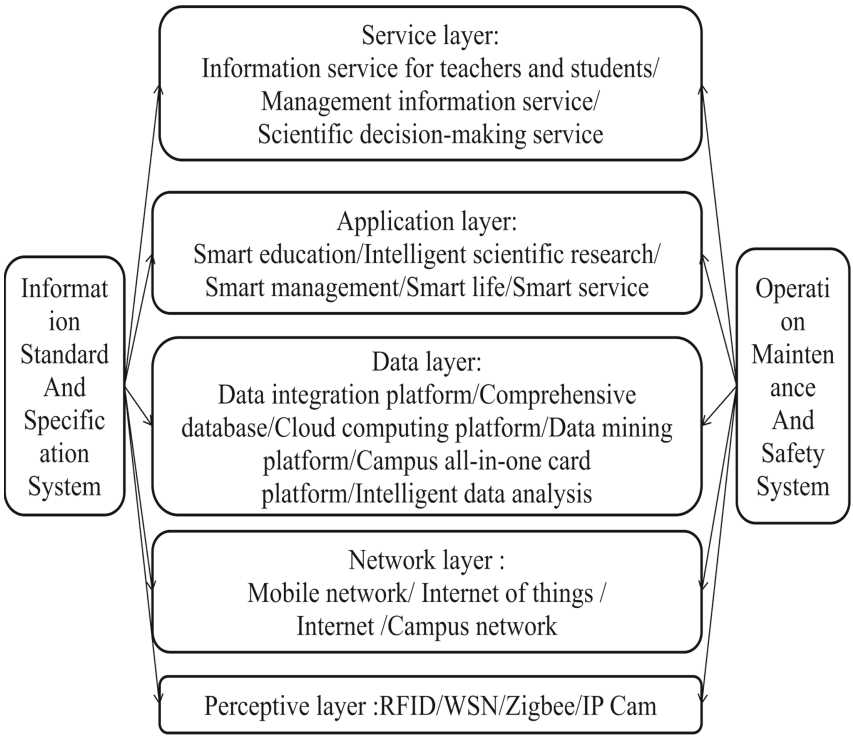

Fig. 2. Overall Architecture Model of Smart Campus Construction (Own Draw)

6 Conclusion

The survey on the current state of teachers' media literacy reveals that the general level of teachers' media literacy is relatively high, with no significant disparities among instructors of different genders, educational backgrounds, or ages. The examination of teachers' need for intelligent campus construction reveals that teachers have a significant demand for intelligent campuses. Teaching, educational administration and logistics support, and intelligent office are the dimensions in which demand is greatest to least. According to a survey of teachers' needs for smart campus construction, the greatest demand for teachers is "needs for school intelligent service teacher marking and score analysis," followed by "needs for school intelligent service and support for students' personalized learning" and "needs for school intelligent service for precise teaching supported by big data".

According to the study and research, although the overall state of media literacy among teachers is excellent, there is room for improvement. By mastering the application of media methods, teachers should develop their ability to filter and distinguish media information. Concurrently, the building of smart campuses should be hastened in order to fulfill the daily education and teaching needs of instructors, and platforms should be constructed from the perspectives of teaching, educational affairs, logistics support, and intelligent offices. In addition, the development of a smart campus should fully address

the demands of teachers, with an emphasis on the effective design of student performance analysis, evaluation, and personalized student assistance, enabling teachers to do their everyday instructional duties more effectively.

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