

*The Applications and Effectiveness of Smart Campus in Taiwan Thematic  
Research Project*

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**Abstract**

In recent years, many countries have introduced ICT-related applications in learning, energy saving, management and others on campus in attempt to alleviate the burden of teachers and administrators and to improve the effectiveness and results of learning. To help Taiwan's enterprises to provide products and services in line with the international development and to meet the needs on campus, the Industrial Development Bureau of Ministry of Economic Affairs in Taiwan launched a thematic research project, inviting 3 system integrators in Taiwan to develop comprehensive systems which cover six different aspects, including learning, social, governance, management, energy and health. So far, thirty five example schools have established. The collected information of the six aspects is integrated. The result after introducing the ICT applications is apparent, and the schools with good practices of the ICT tools has obtained solid and clear results or improvement in learning, governance, security and etc. For example, a junior high school in the remote area has seen the improvement of students' scores of the senior high school entrance exam by over 50%.

Keywords: Smart campus, education, Taiwan, Smart learning

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## **Introduction**

According to the statistics of the Ministry of the Interior of the Taiwan government, the population in Taiwan is 23,373,517. As for the statistics from the Ministry of Education of the Taiwan government, the number of the students and teachers in schools totals 5,381,933, sharing 23% of Taiwan's whole population. The number of schools in Taiwan is 11,426 in 2013. The teachers and most students spend at least 8 hours in schools. Therefore, from the number of schools, teachers and students, the people and the activities in schools take a very important part in the society. The services and innovative applications provided to schools have significant meanings to the whole society.

In recent years, many countries in Asia promote smart campus actively. Most applications are focused on smart learning, smart social activities and smart management. For example, the Japan projects, "Future School Promotion Project" and "Learning Innovation Project", are the launched respectively by the Ministry of Internal Affairs and Communicaitons and the Ministry of Education, Culture, Sports, Science and Technology. According to Japan Ministry of Internal Affairs and Communication (MIC)'s report (2013), Ministry of Education, Culture, Sports, Science and Technology has collaborated with MIC to work on "Future School Promotion Project", a 4 years project started with 10 primary schools in the fiscal year 2010. Then, 8 junior high schools and 2 special support schools participate. Meanwhile, "Learning Innovation Project" of MEXT was implemented in the same 20 schools (10 primary schools, 8 junior high schools and 2 special support schools). Interactive whiteboards and tablets in some elementary schools, junior high schools and supportive schools have been used as examples to locate problems or issues. [a]

Also, the Chinese government also provided national guidelines or launched various plans to promote smart learning, like "National Outline for Medium and Long-term Education Reform and Development (2010-2020)" [b], "Ten-Year Development Plan of the Informatization of Education (2011-2020)" [c] and the "China Action Plan for Digital Education 2020" [d]. The mentioned guideline and plans were intended to improve various aspects of digital and information education so as to strengthen education and foster talents.

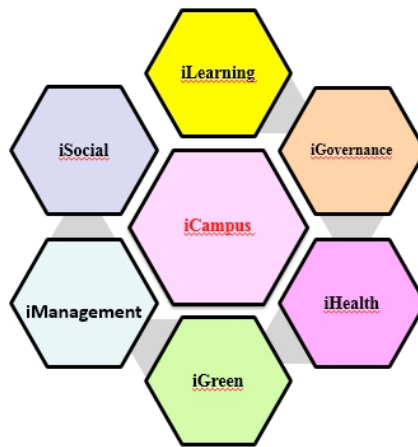
## **Literature Review**

As for the study of the smart campus, Estisilat-BT Innovation Center [EBTIC] (2010) [6] provided its definition and scope about smart campus which covers 6 aspects, including "iLearning", "iSocial", "iGovernance", "iManagement", "iGreen" and "iHealth". These aspects can work independently and inter-dependently to integrate campus with interactivity. The following is the brief introduction of each aspect:

1. iLearning: The eLearning or any other eresources of learning to form an holistic learning environment.
2. iGovernance: The governance inside and outside campus.
3. iGreen: Energy saving or harvesting for sustainability with ICT tools.
4. iHealth: Prevention and epidemic alert healthcare system and various tools.
5. iSocial: Networking and communication.

6. iManagement: Various management, maintenance, surveillance and others in a centralized fashion.

Figure 1: The 6 aspects of iCampus



### Methodology and Method

From 2002 to 2011, Taiwan has implemented “Taiwan e-Learning and Digital Archives Program” and has laid the foundation of Chinese digital contents and fostered the talents in this field. Thanks the development in these 9 years, the Chinese contents and materials had been digitized successfully. According to the e-Learning Industry Output Value Report 2013 (Industrial Development Bureau of Ministry of Economic Affairs, 2013) [7], the e-Learning industry was categorized into 4 groups, including digital materials, platforms, learning services and hardware. The percentage of the output value of each group is 37.85% for hardware, 37.18% for learning services, 19.13% for digital materials and 5.85% for platforms.

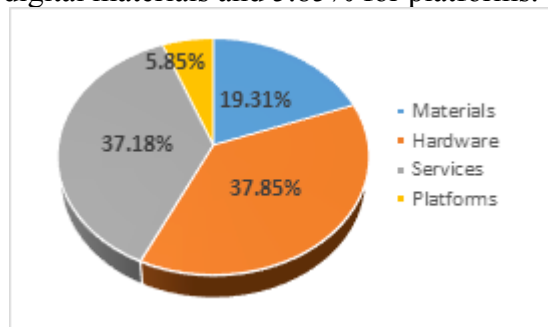


Figure 2: The percentage of the output value of the 4 groups in the e-Learning Industry in Taiwan (Industrial Development Bureau of Ministry of Economic Affairs, 2013)

The maturity of the talents and the industry helps the promotion of the smart campus. In order to promote the smart campus industry, the government introduced the thematic research project with the participation of the enterprises. 4 strategies go with this thematic research project. First of all, the government promotes the standard in line with that in the international community. Secondly, the government promote innovative smart services and solutions of the integrated cloud services so as to form the industrial value chain of the smart campus industry. Thirdly, example schools in the rural and urban areas are established for field verification and to narrow the gap between the country and the cities. Also, the experiences are very helpful for the potential customers or clients in the international market. Finally, the government

endeavors to assist the enterprises in Taiwan to succeed in the market overseas and establishing the image of international brands.

The promotion encourages the enterprises in Taiwan to integrate the technology or applications of the green industry, wearable devices, learning devices, cloud platforms, information services and others so as to form a comprehensive value chain to be competitive in the market.

The international standards are introduced to integrate the software, software and services in order to solve the compatible problems of different systems or equipment. In order to achieve this goal, there are two parts in the process. Firstly, enterprises are invited to form the special interest groups and starts the system interface integration of cross-disciplinary applications in order to promote the integrated standards among the 6 aspects of smart campus. In addition, the “Education Cloud” services are also integrated, including the database of the learning records, learning portfolio, school rolls, health, school affairs and others.

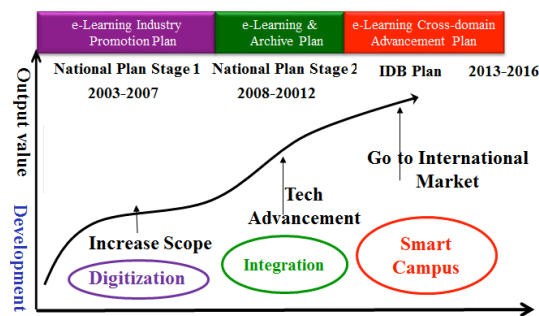


Figure 3: The stages to develop the e-Learning Industry (Industrial Development Bureau of Ministry of Economic Affairs, 2013)

## Conclusion

The purposes of the smart campus thematic research project are to integrate hardware and software for the supervising department’s convenience of management among schools, to provide a future-oriented learning environment and to narrow the gap between the rural and urban areas. So far, the following things have been achieved.

(1)35 example schools in Taiwan and 9 example schools overseas: The thematic plan has the participation of 3 major system integrators in Taiwan, including Wistron Corporation, Delta Electronics and MiTAC Information Technology Corp. By bringing the resources of the big enterprises, these 3 companies are able to link the small-and-medium enterprises to develop the innovative services or applications in the 6 aspects of smart campus. 35 example schools are dispersed in 9 counties in Taiwan, and 9 example schools are established respectively in China, Thailand and Vietnam.

(2)Collaboration with overseas partners: In order to have close co-operation with the overseas market, the enterprises in Taiwan work with their overseas partners. For example, one of the partners in Vietnam has helped Taiwan enterprises enter the Vietnamese market by providing the products or services of smart classrooms, digital textbooks and training. Based on the long-term partnership, 4 example schools are

established there for the schools and the government in Vietnam to know the benefits of smart campus.

(3) Participation in innovative services or applications: The thematic research project also collaborate with other education related organizations, like Institute for Information Industry [III] to implement the innovative models of services or applications. “The Small School Alliance” is one of the successful works. III has been commissioned by the Industrial Development Bureau of Economic Affairs to implement the national plan called “e-learning Industry Cross-Domain Advancement Plan” [9]. The enterprises joining the thematic research project of smart campus also participate in the activities of Small School Alliance.

Small School Alliance is intended for the small-sized schools in Taiwan to obtain good education resources in an economic way. When these schools enjoy the resources provided to them, they can also share their special lessons with others. For example, the schools in the mountains can share their special ecosystem in their environment.

The resources are not just in Taiwan. The activities of exchanges are also held with those in Singapore, Vietnam and Malaysia. The English teachers from the Philippines are connected with the students in Taiwan to bring special learning experiences to students and to improve students English. This kind of real-time interactive online lessons also brings apparent improvement in different subjects. For example, the level-Based, real-time adaptive English lessons result in distinguishing outcome: 25.74% progress in metropolitan school, while 38.18% progress in remote schools. After completing the full English, long-distance, level-based English courses taught by foreign teachers, the research results showed that the average score of progress for the whole class at schools in metropolitan areas is 17.73, with a rate of 25.74%; the average score for schools in remote villages is 21.2, with a rate of 38.18% (The result of performance belong to the plan sponsored by the Industrial Development Bureau of Ministry of Economic Affairs and will be posted for the reference of the general public in Taiwan according to its schedule. The detailed implementation will be presented in this December in IEEE TALE2016 in Bangkok, Thailand.) The Table 1 shows the results of 2 schools joining the real-time interactive English lessons.

Table 1. Comparison of Level-based English learning progress between urban and rural schools

Groupings based on level	Degree of progress in urban schools	Degree of progress in rural schools
High achievement	19.59%	15.98%
Middle achievement	25.67%	33.91%
Low achievement	101.04%	76.37%
Average of the whole class	25.74%	38.18%

Also, Baolai Junior High School, a junior high school less than 100 students in the remote area, has seen the improvement among the students of the middle level in their senior-high-school-entrance-exam scores by over 50%.

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