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## Design and Implementation of Home-school Full Communication System Based on Students' Curriculum Learning State

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**Abstract:** In china, home-school Communication system used in the current market is of low efficiency and other campus digital solutions for the promotion of home-school communication achieved little too, because the traditional infusion teaching model is widely applied on classes. Thus a Home-School Full Communication System based on students' curriculum learning state is proposed to solve these problems. This system takes technology strategies and management strategies into account. The management strategies, including learning status tracking, evaluation of the growth index and statement sets and its pattern, make students' learning state tracking digitized, calculated and counted, which helps to interpret the growth characteristics from different sides. The technology strategies focus upon the implementation of light information systems for mobile intelligent terminal operation. There is an instance about Home-School Full Communication System to explain the effect the system achieves. The example has also shown that the solution is feasible, which can provide an effective tool for these classes of Chinese new curriculum reform.

**Key words:** Architectures for educational technology system, improving classroom teaching system, evaluation technology, interactive teaching system

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### INTRODUCTION

According to the modern education theory, the obligations of parents not only include affording the necessary fees but also providing assistances for education. Besides, parents also have rights to help schools improve their education. The prerequisite to realize such rights and obligations is to unblock the communication channels between the school and the family. However, even if the channels are unblocked, improper communication means or contents can also induce communication obstacles between schools and families, resulting in the imbalance between rights and obligations that parents only have obligations to pay money. In China, there is a so-called "home-school communication" system, its main function is: When the students arriving at school or leaving from school, schools inform the state of children by sending messages to their parents' mobile phones, sometimes coupled with test scores of students. Another kind of "home school" system is that parents can access to their children's school information system via the internet to get some information. Due to the limited conditions, the latter system has limited effect in application; in contract, the former is widely used for its simple operation.

Nevertheless, through the way to get children's information in school, this communication is still very limited, so it is called "home-school limited communication". The reason is that parents know little about children's learning, such as their learning abilities, hobbies and quality characteristics. However, with existing information collection and processing mode, even teachers can not have a better understanding of each student. Therefore, there are problems in the method and content of this kind of communication method. This article discusses a kind of home-school communication system based on students' learning state to improve the method and the content of communication and achieve full communication.

### REVIEW OF TECHNOLOGY OF HOME-SCHOOL COMMUNICATION

In China, home-school communication is a part of the "digital campus Intelligent Information Management System". The "digital campus Intelligent Information Management System" refers to use the computer, the Internet of Things, RFID (Radio Frequency Identification) and wireless communication technology to create four digitized campus experts for campus safety, campus

payment, home-school communication and information collection, conduct real-time feedback on students' attendance, learning, exams, homework, medical information, consumption and other daily situations and realize a convenient and real-time interactive platform for Schools and Parents communicating education information (Chengdu Zhongshan Technology Limited Company, 2012). However, from the current perspective of information communication, the fusion of traditional computer network and wireless communication networks is the most basic infrastructure for the current digitized campus. Recent years RFID is widely used in the technology of logistics and supply chain management (Sundaram *et al.*, 2010). The recognition system can easily judge the location of items with radio tags, with the maximum reading distance up to 10 meters. RFID encodes up to 128, which uniquely identifies an item, if students carry around with this RFID, it can uniquely identify a student and determine whether he or she is at school or leave from school. Once connected with campus information management system and access to wireless messaging platforms, the system can inform parents that their children are in attendance or absence by messages.

Sending students' assignments and examination results to their parents can be completely achieved by traditional management information system. SMS (Short Message service) functions are no longer strange for the management of information systems and even become one of the basic components. This transactional information system structure is usually presented in B/S or B/S/S (Browser/Web Server/Data Server) mode, whereas the system on level of decision support is very rare, especially those involving students' hobbies, the development trend and quality characteristics. Entirely distinct from the enterprise transactional information systems, which is based on any daily trivial affairs, while the campus electronization is based on phased affairs. It makes parents unhappy because not all of the information is needed by parents. The information without screening and selecting are usually sent to parents, while those about their children's personalized growth characteristics are hardly attained.

The current home-school communication system depends upon the transactional information systems, which means, in theory, as long as attain students' information, it will be able to achieve communication needs. In the western, there is a campus information management system called electronic portfolio, which is highly respected but rare in China. The electronic portfolio is used to record the process of students' growth in dribs and drabs, usually with realistic

description, mainly related to reward and performance (Liu and Zhou, 2007). In abroad, this electronic portfolio is used to guide students for the skills of self-adjustment, evaluate medical staff and teachers (Cambridge, 2008; Attwell, 2007; Alexiou and Paraskeva, 2010; Garrett and Jackson, 2006) However, this model is not used for home-school communication. New curriculum reform in China has advocated a process evaluation method by using paper-based tools, in different forms but the same purpose, called Growth Record Bags (Liu, 2004; Guo, 2011). The reality is that in the growth record bags of children, in addition to the final grade and the head teachers' comments, other places are all blank. Whether electronic or paper, the information collection entirely depends upon the head teacher, which apparently has too many problems.

The data in the students' growth processes can only be the accumulation of their learning state. The definition of students' learning status in China and abroad includes two aspects: psychological state and physiological state (Zhang and Liu, 2011). The physiological state is easy to be recognized since it is explicit and easy to be used but the impact is limited. In education theory, psychological status has the most influence on study (Liu, 2003). Although mood, motivation and attention are more likely to be considered as a psychological quality and give directly influence on study but relatively stable. The starting point of the new curriculum reform is more inclined to take advantage of the stability, combined with teachers' guiding, to help students to form a better learning state, so as to improve the learning effect. Changes of students' learning state normally can only be screened from some explicit phenomena and the useful information can only be observed from a series of events, coming from the limited-time classroom activities. Obviously, it's unrealistic to fully depend on the teacher in charge of the class for this work, not to mention that the current system does not provide the necessary data accumulation and post-processing tools.

After all, if the teachers do not know the students and the students do not know themselves, parents will not be able to understand their children's growth and it is impossible to realize home-school communication. Therefore, the various strategies of existing system cannot solve the problem of feedback delay and low efficiency. It is essential to adopt a new data acquisition strategy, process strategies and mobile smart technology to solve problems in the current home-school communication so as to realize home-school full communication.

**DESIGN OF HOME-SCHOOL FULL COMMUNICATION SYSTEM**

**Design goals of home-school full communication system is:** Under the condition of limited time, energy, financial resources and capabilities, it could help teachers, including teacher in charge of the class, to be familiar with the students' learning characteristics; meanwhile, it could also help parents clearly realize the growth state of students and grasp students' learning ability, hobbies, quality characteristics and then provide a decision basis for them to foster students and promote their healthy growth. Figure 1 is the system structure of home-school full communication system. This system still uses B/S/S structure; each system can satisfy at least one curriculum teaching management. Each curriculum exchanges data through the network, corresponding with the status that one student at least learn one course in a semester. The characteristic of the system construction is the merging of technology strategy and management strategies, focused on solving the data acquisition and processing problems.

**Management strategies:** The system, adopting management strategy in the design, contains two aspects purposes. The one is to make full use of hardware resources and realize its effectiveness maximization; the other is to realize student learning state tracking management and provide decision basis for each side. Figure 2 is management strategies hierarchical chart used in the system design. The fundamental task of the system is to facilitate the sharing of information through quick

access and rapid acquisition. Based on this, we can ensure adequate data to provide effective information for future decision-making of each side. At the same time, it guarantees that the teacher can use a few minutes to manage students within 45 minutes, without affecting teaching. With these fundamentals, we can achieve three major strategies: learning state tracking strategy, growth index evaluation strategy and statement sets and its template strategy.

**Learning status tracking strategy:** There are two goals of status tracking: the one is to accumulate the data about students' behavior characteristics in the teaching activities; the other is to feedback the characteristics about their needs from history records. This information can be quickly recorded via specific method, for example, providing a "common statement sets" to be used in option, including:

- Statements of attendance, including: absence, coming late, leaving early, sick leave, private affair leave. Actually six kinds of information are included, being very exclusive. In attendance is the opposite of absence. "In attendance" means coming to class and "absence" means not coming to class
- Statements of interaction, including "free interactive evaluation statement "and" problem-oriented interactive evaluation statement", such as basically right, very correct, quite right, less appropriate (suitable), very challenging, creative, very creative, etc

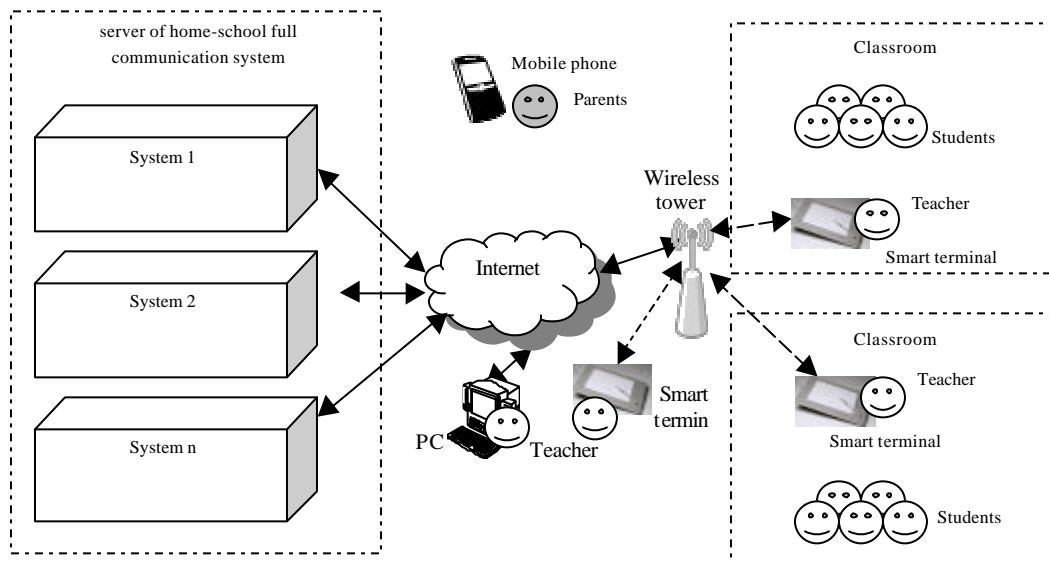


Fig. 1: System architecture

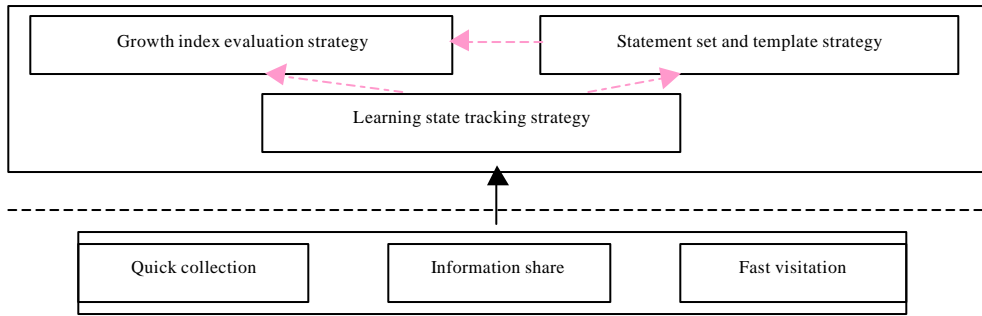


Fig. 2: Management strategy of home-school full communication

Table 1: Descriptive statements of common classroom behavior

Disciplinary problem	Character problem	Mood problems
Unquiet, chat constantly	Not a joke	Play mobile phone from time to time
Play mobile phone, make a phone call	Cannot accept criticism	Talk about something from time to time
Make trouble	Yield without self-confidence	Pull classmates from time to time
Confront with teacher	Withdrawn, loner	Glance right and left from time to time
Smile but constantly talk	Yawn repeatedly, listless	Frown all day
-	-	-

- Statements of common classroom behavior characteristics, used to describe the outside characteristics of the so-called "problem students". These statements point to various aspects, generally including discipline problems, personality problems and emotional problems, as follows listed in Table 1

In addition to the common statements set above used by teachers in active record, other data are automatically recorded by machine, including: "physical" tasks and practice status information, classroom group discussions in "physical" form, the virtual online case analysis, online exercises completion, discussion participation in virtual ways, such as releasing information on BBS, forums and blogs.

**Growth Index evaluation strategy:** Growth Index is used to measure students' learning efficiency and teachers' teaching efficiency. For teachers, it is used to assess their teaching efficiency and to adjust their own teaching strategies, including the allocation of teaching resources to students; for students, it is used for self-reflection, timely adjustments and improvements of learning approaches. Growth index evaluation strategy combined with subjective and objective evaluation, multi-objective and comprehensive evaluation coexisting. Subjective evaluation is usually from the judgment of teachers; the objective evaluation is automatically rated by the computer. Multi-objective forms include indexes on moral behavior, innovative ability, academic performance, teamwork, diligence. The comprehensive index is an index

in growth levels integrated by the five indexes just mentioned and based on the needs of assessments; the corresponding absolute index and relative progress index are constructed. Due to space limitations, this article does not present the evaluation index system and you can refer to another article "Students' Growth Dynamic Evaluation Modeling Based on Curriculum Learning State Tracking" or the work "Generalized Reciprocal Teaching Mode Theory, Methods, Practices and Support Systems".

The growth index data is completely based upon data collected during status tracking process. Any changes in the data are likely to cause index changes and some data can interpret from different aspects, which affect the calculation of a range of indicators. For example, if the students did not complete tasks, it not only affects the learning performance but also affects the morality and diligence degree. Apparently, such an evaluation is more realistic. Index calculation time must be chosen according to certain rules, which is called the calculation size. On one hand, it is not necessary to implement too intensive calculation, which consumes a lot of calculating resources. On the other hand, with too long computing cycles, the index without changes in a long term will lose the significance of the evaluation.

Although, though arithmetic and mathematical statistics dealing methods, most of the calculation can be completed, yet the most difficult part for constructing Growth Index is quantification. The reason is that, even if all inputs to the computer information are digitized and the data are structured, not all the structural data are suitable for calculation. Besides, descriptive text differences and

different angles produce different interpretation. Therefore it needs specific standardization strategy. That is the strategies of statements set and template which will be discussed in following.

**Statements set and template strategy:** The original intention of the statements set and template strategy is to ensure quick access, fast recording and rapid decision-making. Evaluation and description of the status of the students in the classroom need teachers to complete in a limited period of time and any form of keyboard input may waste too much teaching time. Thus, three types of statements set were designed, including: common statements set of attendance, common statements set interactive evaluation and common statements set of behavior. In addition, it can also be divided into 2 subsets: individual and group. Each sentence of the statements in the computer contains two kinds of information: the first is the text message describing the state characteristics explicitly; the second is the hidden information of number, which formed the so-called key-value model. It needs computer template for selection.

The research team used the questionnaire in the field to gain “value” corresponding with each “key” in a common statements set. The “value” is generally regarded as the target influence, including positive and negative points. The survey results of the influence of four groups are as follows:

- Following Table 2 lists the appraising extent of capacity development described by teachers’ evaluation with common statements sets, from 0 to 10 points
- Following Table 3 lists common statements set of some abnormal learning state, describing the degree of negative impact of behavior characteristics on study, compared with the normal situation "0". The degree is divided into 10 levels.
- Following Table 4 lists the common statements set of enhancing learning effects, used to evaluate the positive impact, compared with the normal situation "0". The strength is divided into 10 levels
- Impact of attendance on growth is apparent. Compared with the normal situation "0", other situations are used weakened mode. The strength is divided into 10 levels, as shown in Table 5

Obviously, the establishing and template of statement sets, is not only for rapid processing, more importantly is to quantify and normalize for suitable

Table 2: Impact on study and its appraisal strength of positive reciprocal evaluation

Common statements	Appraisal extent
Very good, creative	10
Not bad, with new ideas	8
Need continuing to learn	5
Not appropriate	2
Completely wrong	0

Table 3: Impact on study and its strength of descriptive statements of negative behavior

Common statements	Strength
Playing games	-10
Listening to MP3	-8
Laughing, muttering	-6
Sleeping	-5
Whispering	-3

Table 4: Impact on study and its strength of descriptive statements of positive behavior

Common statements	Strength
Systemic perfusion	+6
Active thinking	+8
Actively answering questions	+10
Like to discuss issues	+3
Like to ask questions	+5

Table 5: Impact on study and its strength of descriptive statements of attendance

Common statements	Strength
Absence	-10
Late	-5
Leave early	-2
Sick leave	0
Leave	-1

computing and mathematical statistics from different sides to understand students' learning state.

**Technology strategy:** As previously discussed, if you want to achieve the above management strategies, it also needs some precondition to guarantee rapid access, rapid acquisition and information sharing, which need certain technical means and tools; this paper focuses on mobile computing devices. Thus, technically, when designing home-school full communication systems, first of all, it needs to ensure that each classroom teachers can easily access to the historical information of students and then be able to carry out the quick update of student learning status. Then, the data of each course can be exchanged when needed. Thus, such a system can be referred to as the single-course system. Supported by network, it can construct the curriculum system network through the introduction of cloud computing. The technology design framework of home-school full communication systems as shown in Fig. 3 and its core technology is to realize mobile operation.

**Hardware platform strategy:** The core hardware of home-school full communication systems is mobile

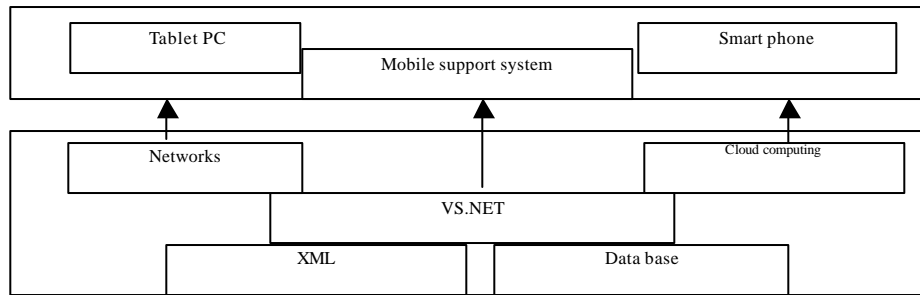


Fig. 3: Mobile technology strategy of home-school full communication

computing terminal, mainly referring to tablet computers, smart phones and light notebook computers with lasting power. From the operating system, the mobile computing terminal can be divided into open Android, closed windows and IOS. If you choose B/S model, the three machines can be indiscriminate but it needs to consider to adopt WAP or HTTP access mode; if adapt the C/S mode, they will be lack of compatibility but the same point is that web service technologies are available. The choice for mobile computing terminal mainly depends on sustained work capacity of the battery life. It is the most appropriate for more than four h to ensure the needs of teachers in a morning or an afternoon.

**Cloud computing strategy:** Cloud computing is a commercial computational model and it distributes calculation tasks in the resource pool of a large number of computers, enabling users have access to computing resources, storage space and information services as needed. This resource pool is called “cloud”. It should be said that the industry promotes the development and research of cloud. Such as Google, Amazon, IBM and the IT giants Microsoft, they have made great contributions and are now providing cloud services. Any enterprise of any scale can also build their own cloud services.

The purpose of the introduction of cloud computing is to make each curriculum to form a huge learning system through networks, sharing powerful computing capabilities, information storage and information retrieval, which is the necessary underlying technology to give a comprehensive evaluation of students’ growth characteristics and help the parties involved get fully communication.

**Development tools strategy:** According to the analysis of China’s domestic university teaching status, a course attracts not more than 100 visitors a day on average,

about 10M space requirements per week, which will only make the database an expansion of 6M around per semester. Supported by cloud computing, Home-school Full Communication System is in need of flexibility. So the strategies of development tools include:

- Desktop database Microsoft access is a good choice, which is suitable for transplantation, conduction, copy and share. Integrated well with Microsoft VS.NET development tools, it can greatly increase the speed of development
- To store data, except the option of database, XML is very flexible and it is very convenient to use in some system configurations. XML can also be used to complete the personalization of the user and the storage task of other strategies
- VS.NET development tools present their own unique advantages for all windows platform and support the development of tablet computers and smart phones based on windows platform. From the version 2010, VS.NET can totally support cloud-based application development

### IMPLEMENTATION OF HOME-SCHOOL FULL COMMUNICATION SYSTEM

Several instances implemented by Home-school Full Communication System were shown in the screenshots below. Home-school Full Communication System, based on B/S/S structure, is a part of curriculum-based intelligent support system of Generalized Reciprocal Teaching mode. There are one class and 42 students in this system and as stated before, it must include the following typical components:

- Teachers can record, track, retrieve students’ learning state by the system and adjust their teaching



Fig. 4: Operation interface of recording students' status with tablet computer

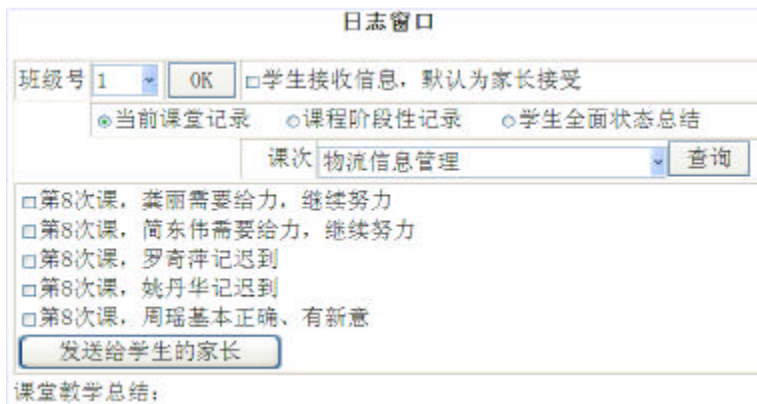


Fig. 5: Operation interface of sending short message to students or parents

methods according to the overall effect, as shown in Fig. 4. How to adjust? We can find different rectangles with different colors and length under every one student. Red, yellow, gray and black correspondingly describe the indexes: interaction, on class, quality and growth. The longer the rectangles are, the stronger the index assessment is. If someone student's index evaluation

strength equals default value 80, any rectangles will not be showed under someone

- Parents can communicate with teachers via SMS and the more important is they can receive messages about their children's learning state, including in a single class and a learning phase, from the system sent by teachers, as shown in Fig. 5 and 6



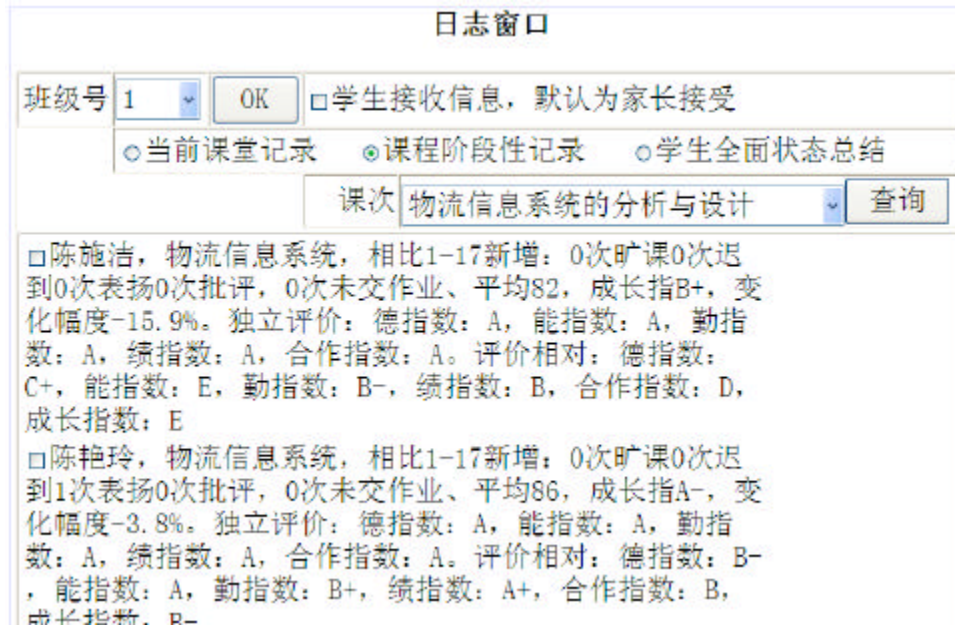


Fig. 6: Operation interface of sending phased evaluation message



Fig. 7: Feedback interface of status information after students' login system

- Students can recognize their learning state and their own inadequacies and then adjust their learning methods on the basis of it, as shown in Fig. 7

Figure 4 is divided into two parts: The first part is a list of information of students, listed according to students' actual seat and below each name, a variety of data describing students' state are listed and a select button is offered for teachers' use. The second part is divided into three types of template of common statement set, realized by three dropdowns. After teacher assigned a student, he can quickly select the appropriate statement

to describe student status and through clicking on the button to submit the data to the server and store it in the database.

Figure 5 is a screenshot of Summary window, listed the record of each lesson, in which the teacher can choose to send messages to students or parents to make them know the classroom performance. If the parents were told that their children answered the teacher's question, certainly they could know their children were in school.

From the perspective of educating and cultivating children, parents are in great need of more comprehensive information of children. At least the phased evaluation of children's growth shown in Fig. 6 is in need, including

various aspects of children and evaluation of children's growth from the perspective of individual and overall. The function of the information is to allow parents to adjust their education mode based on the situation of children's development and also help children do some self-reflection. In Fig. 6, the receiver of the information can be either students or parents. Teachers can exchange data between the systems of each course and those dates can be collated through the main system, then a more comprehensive Growth Indexes are calculated.

Students can log in the course system via a PC to study. After logged in, their learning status can be checked instantly, as shown in Fig. 7. The system is described by 6 Indexes and a graph of growth change. Each of the six indexes is described by 10 pentagrams, the more hollow pentagrams, the worse it is. The effect index change graph in the upper right corner shows the index changes after teachers summarized in each stage. The life cycle of student evaluation index is 48 h.

## CONCLUSION

Home-school Full Communication System has made up the single and limited feature of current communication between home and school. And it has also solved the problem that it is laborious and difficult to record and compute students' learning status statistics by manual recording. The system can make the "growth record bag" electronic in new teaching reform and allow teachers and parents to adjust their strategies to promote the overall development of students according to the change of students' learning status. From the application of this system, all the goals need to be achieved can totally be reached by the system but the ability to comprehensively grasp the student growth situation is still controversial, some intelligent data analysis work need deeper research, especially a more scientific regulation to predict behavioral tendencies is in great need to provide decision-making guidance for the school and the family to educate children. Even so, the effect of the hardware strategy and management strategy proposed in the system is obvious for the design of information systems to solve the communication problems between the parties involved.

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