

Success Factors for Smart Schools Emphasizing the Role of Information Technology: A Case Study

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Abstract - Smart school is a learning institution that has been systemically reinvented in terms of teaching-learning practices and school management in order to prepare students for the Information Age. Information Technology or IT, as an important pillar of smart school system, has different roles in the system from facilitating teaching and learning activities to assisting the school management. The aim of the research is to investigate the smart school activities in Iran in order to propose an IT framework for improvement of the smart school system in Iran. Although in recent years some efforts have been done for developing smart schools in Iran, there is still no comprehensive solution for development of smart school system to be referred. This research has employed mixed methods, encompassing qualitative and quantitative methods in order to identify success criteria for development of smart school system. Twenty success criteria were identified, among others, Information and Communication Technology or ICT skills, ICT use rate, application use rate, and ICT courseware. The proposed IT framework developed based on the criteria success is used to investigate current activities of smart schools in Iran, and to assess five cases in Iran through interview and observation methods. The findings indicated that these schools should have electronic contents for all courses, high speed networks, Internet lines, computers, printers and other related equipments to become complete smart schools. The framework provided a set of guidelines in terms of smart school components in a structured way, which can assist the Ministry of Education of Iran and top-level policy makers to improve current activities of smart schools in Iran. Besides, the research also contributes towards the expansion of theory and knowledge of smart school which could benefit to other developing countries.

Keywords - Technology, Smart School, ICT Implementation Plan, Education material

1. Introduction

The smart school project in Iran has been inspired by a similar project undertaken by the Malaysian Ministry of Education (Attaran & Siraj, 2010). In Malaysia, the idea of smart schools was proposed in 1997 and became operational in 1999. According Research objectives and significance of the study are discussed for a smart school to achieve its educational objectives, these teaching and learning concepts. The researcher hopes this study will help ministry of education of Iran to improve current activities of smart school and attempts to provide a standard framework for development of smart school. In addition, one of the concerns is to balance education facilities in rural areas and urban areas in order to reach educational justice in Iran. The status quo of smart schools in Iran was examined and lack of IT infrastructure standard for smart school systems was addressed. Research findings of Wan Ali, Mohd Nor, and Alwi (2009) show that time, course content and technical malfunction were the main problems teachers faced during the process of ICT integration in Malaysian smart schools. In their research, Mahmoudi, Nalchigar, and Ebrahimi (2008) found that the basic challenges of Iranian smart schools were the lack of necessary rules and regulations in the Ministry of Education and the traditional structure of Iranian schools.

Attaran and Siraj (2010) showed that teachers and students do not hold a positive attitude towards teaching and studying in Iranian smart schools. Furthermore, the results of their study revealed that in order to increase the efficiency of smart schools, educational institutions should be provided with further equipment, and teachers should attend ICT training courses, undergo extra training and receive benefits for their participation in such courses. Moreover, educational courses for the students should be presented through diverse models that correspond to their talents. Traditional routines in class should be abandoned and each class should be equipped with computers and peripheral devices

As research findings by Niemi et al. (2012) have shown, “mere investments in technical resources or in infrastructure do not create new school cultures and learning experiences that promote twenty-first century skills and learning”. The present research which aims to probe the impact of ICT integration in smart schools (as an organization or community) has chosen the Absal high school as its case for study. Absal high school is Iran’s oldest smart school, which was established and equipped in 2004. The school is located in northeast of Tehran and has been directed under a single administration so far.

2. Smart School Projects in Iran

Smart School project was launched in 2003 in Iran with inspiration from the original idea in Malaysia. Shahid Aghayee was a non-profit school who taught with the use of audio-visual technology. The founder of the school later carried out similar school projects in Yazd and Qazvin province in public high schools (Attaran, 2011). In 2004, four public high schools in Tehran, smart school project was implemented as a pilot project by the Education Ministry in Tehran. In 2007, after three years of implementation of the smart school pilot in Tehran, smart schools began and teachers were taught based on the strategic plan of the project. For the realization of smart schools in this project 100 schools were chosen by Ministry of Education, 50 were part of high schools in different provinces of the country (Omidinia, 2009). Education institution in Tehran in 2010 published a book with the title of “roadmap of smart schools “where in addition to the Smart School goals, how to implement smart schools and their evaluation model were presented. In 2011 the Ministry of Education changed some schools into smart schools in most major cities in Iran. This project seeks a Master Plan which was chosen by education institution for development of ICT in Iran. In fact, officials of Education gradually came to a deeper understanding of global developments and the role of ICT in development (Attaran, 2011). This led to the development of ICT in this phase as a general direction taken by the managers of education. In 2009 the road map of smart schools which was developed by the Ministry of Education of Iran, smart schools have been mentioned as one of the key requirements of knowledge-based societies through the development of knowledge and entrepreneurial skills of students in these schools. Objectives and activities of the schools are based on the Malaysian Smart School but the sub structure are different in two countries.

3. The Theoretical Framework of the Study

The literature shows the terminology of ‘smart school’ has been used in limited countries but most others use these terms: ‘ICT usage in schools’ and ‘ICT integration in schools’. This research has defined a new term as ‘smart school system’, which refers to all components of the smart schools including technology, people, process and education material.

Patterned on the Malaysian model, the smart school project in Iran was launched in 2004. At the pilot stage, the Iranian Ministry of Education implemented the project in four high schools in the capital city of Tehran. Following the publication of “The Road Map of Iranian Smart Schools” in 2011, the project was extended to other educational districts. Like many other countries, an implicit assumption seems to be dominant in the project: that by equipping schools with computer hardware, ICT integration will turn into a mainstream trend (Thang, Hall, Azman, & Joyes, 2010). The 2016 Second Information Technology in Education Study (SITES) reported “financial investments for the educational use of ICT had not been in line with high expectations” . According to previous sections, this research attempts to provide a framework for infrastructure of smart school in Iran. Figure 1.

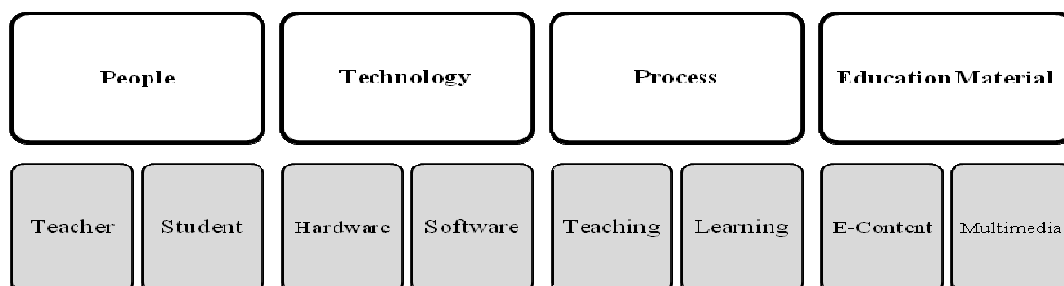


FIGURE 1: PROPOSED IT FRAMEWORK FOR SMART SCHOOL SYSTEM IRAN(KERAMATI ET AL , 2011) , (SANG, VALCKE ET AL. 2010)

Illustrates the general framework and components of this framework. In this framework, four main components of smart school have been identified, namely, process, education material, people and technology. In next levels of this figure, detailed components of this framework have been shown. The literature assisted the researcher to identify the components of the smart school system. Firstly, with referring to LSTA standard, every learning system needs to have architecture. The figure shows four main components in the smart school system can be considered. In next level of the architecture, several components have been proposed. These are derived from previous efforts on ICT integration in schools. the standards, frameworks and related work on ICT integration in education will be compared with the proposed framework for smart school system. IEEE LSTA standard and UNESCO ICT-CFT framework are used as the basis of the proposed framework. Four other related works are compared with the proposed framework for smart school system. Table 2.6 summarizes this comparison. In this comparison, for each standard, framework or prior efforts three subjects have been compared. The second column summarizes the characteristics, methods and approaches of each effort. The third column describes the achievements of each row and the last column mentions the goal of each different solution.

Table 1 : Comparison of standards, frameworks and related work with proposed framework

Order	Standard, Framework and Existing efforts	Characteristics, Methods and approach	Achievements	Goals
1	Scales for Measuring ICT Usage in chools (Hakkarainen, Ilomäki et al. 2005)	This study focuses on assessing what students actually know about ICT	Scales involves: ICT skills, towards using ICT tools	To Measure ICT usage in schools
2	Learning Systems Technology Architecture (LTSA) , (IEEE 2003)	This standard provides a general architecture for a learning system and its components	This standard specifies a high-level architecture	To prepare a general information technology architecture.
3	A roadmap for successful IT integration in schools (Gulbahar 2007)	Qualitative and quantitative research methods were adopted for this descriptive study.	Perceptions of students, teachers and administrative staff related to ICT usage were taken through different questionnaires.	To prepare a technology plan for smart schools
4	ICT Competency Framework for Teachers (ICT-CFT) (UNESCO 2009)	The Framework is arranged in three different approaches to teaching (three successive stages of a teacher's	Technology Literacy enables students to use ICT in order to learn more efficiently.	To provide a common education improvement framework .
5	Role of Student and Teachers in ICT Integration in School (Sang, Valcke et al. 2010)	A survey was conducted through involving student and teachers from four case studies in China.	The results have shown the prospective ICT integration could be directly predicted on the base of teacher thinking	To study the impact of student and teachers attitudes on their prospective ICT use.
6	Readiness factors in e-learning outcomes (Keramati, Afshari-Mofrad et al. 2011)	Readiness factors are categorized into three main factors including technical, organizational and social factors.	In technical infrastructures these factors are mentioned: Proper software and hardware or bandwidth, can play a crucial role in E-Learning outcomes.	To determine the intervening role of readiness factors in the relationship between E-Learning factors and its outcomes.

As Niemi et al. (2012) maintain, to understand ICT integration into the school curriculum, it is better to see schools as communities or organizations so we can more easily gain an understanding of schools' implementations of ICT. As defined in the strategy plan of smart school of Iran, following strategies should be covered:

- Benefiting from modern technologies
- Development and benefiting from the various educational software
- The Definition of the new organizational Structure
- Benefiting from the management system of the school

4. Research Method

Current research adopted mixed methods as the methodology for developing the IT framework of smart school. Such a methodology is based on both qualitative and quantitative data. The quantitative data were gathered via questionnaire. For the qualitative part, the researcher made use of observation, interview and document analysis. Figure 2 show the operational framework of the research.

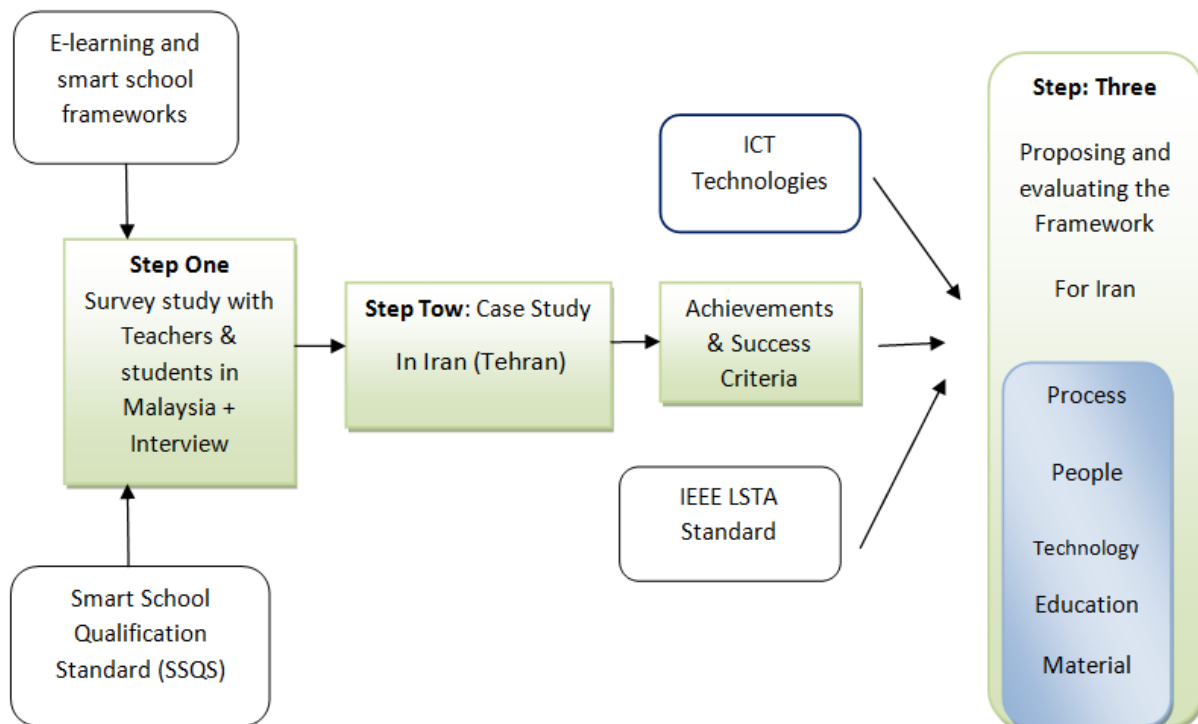


Figure 2: Operational framework of the research.

5. Survey Procedure

Smart school qualification standard (SSQS) model has been combined with the extracted framework in e-learning (Andersson and Gro'nlund 2009) and IEEE LSTA (IEEE 2003) standard in order to prepare a comprehensive questionnaire for collecting data. The survey designed in following steps:

- Two different questionnaires designed and used: student and teacher.
- One pilot smart school has been used to verify and improve the questionnaires.
- These questionnaires have been distributed in 16 smart schools of 88.
- The data have been collected in 14 smart schools.
- The SPSS tools are used to enter data, analyze and interpret the data.
- The analysis of data has been performed.

6. Success Criteria Extension

Using the results of the first round of interviews has confirmed the primary success criteria identified in quantitative analysis in Chapter 4 (Table 1.3). Considering the reported strength and weakness factors of the smart school system through interviews and observation assisted the researcher to extend the acquired success criteria to new success criteria. Table 5.1 categorizes success criteria in four groups. The four categories are people, technology, education material and process. In the people category (class A), three subgroups were identified and for this group five success criteria were extracted and confirmed (SCA1 to SCA5). In the technology category (class B), two subgroups were identified and for this group six success criteria were identified and confirmed (SCB1 to SCB6). In education material group (class C), two subgroups were identified and for this group five success criteria were defined and extended (SCC1 to SCC5). In process group (class D), three subgroups were identified and for this group only three success criteria were derived and accepted.

Table 2: Success Criteria in Smart School System

Class	Subgroup	Success Criteria	Survey	Interview
People (Class A)	Teacher, Student, Administration, Parents	SCA1- Motivation		√
		SCA2- ICT Skills	√	√
		SCA3- ICT use rate	√	√
		SCA4- Internet use rate	√	√
		SCA5- Application use rate	√	√
Technology (Class B)	Application	SCB1- School Portal	√	√
		SCB2- Technical Support	√	√
		SCB3- Management Application		√
	Infrastructure	SCB4- Network		√
		SCB5- ICT equipment	√	√
		SCB6- Internet access	√	√
Education Material (Class C)	Course, Media	SCC1- ICT Courseware	√	√
		SCC2- Education Resource Access		√
		SCC3- Multimedia content	√	√
		SCC4- Web-based		√
		SCC5- Content management		√
Process (Class D)	Teaching, Learning, Assessment	SCD1- Multimedia Teaching	√	√
		SCD2- Remote Learning	√	√
		SCD3- ICT Based Assessment	√	√

7. Research findings and Discussions

Through several visits of smart schools, the finding has shown that the smart schools activities have started based on different thoughts and experiences in various pilot smart schools and they have not only similar issues but also different problems for development.

Although in recent years some efforts have been done for developing smart schools in Iran, there is not a defined and an efficient way for establishing IT environment for smart schools. Based on the interviews in different levels of organizations, namely, ministry of education, education offices of states and cities and finally in several pilot high schools that have planned to become smart school, it realized that there are many concern on development of smart schools. For instance, these schools need to have electronic contents for their courses, special networks and Internet lines and also they should have computers, printers and other requirements to become a real smart schools. In fact, it realized that an IT framework and architecture is required for executives to coordinate all programs and activities in developing smart schools. This framework also will help all participants to define their activities and roles in spread of ICT platforms for smart schools. The following are proposed strategies to improve and develop the use of ICT in smart schools:

- Develop a national IT framework that is appropriate for primary, secondary and high schools, as well as vocational training centers.
- Train specialist teachers to develop ICT teaching in smart schools.
- Train ICT specialists in the Education Department.
- Introduce smart school principals to use of ICT.
- Hold training seminars to introduce families to the use of ICT in teaching.
- Activate parent-teacher associations to support the use of ICT in teaching.

By presence in the pilot of the smart schools and having conversation with the directors, teachers and the students, we were informed about the comments of them upon the implementation of this plan. The main activities of such schools consist of the hardware equipment, creating the facilities of the network, production of the educational software and the internal network, the room for content production, the computer site and the classes which are equipped with the computer systems, the video projector for the education. Besides, these activities have been done along with the educational classes and encouraging the teachers and students and some schools have signed the contracts for creating the software and diligent websites with private companies which are being completed in line with the objectives of the plan.

Table 3 : Important Findings in Iran Case studies

Issues	The Results
<p>The Characteristics of a smart school in the Point of View of the Authorities of the Schools</p>	<p>The educational environment, the educational communications in the form of face to face The possibility of creating all of the communications based on the network and the electronic The change in base of the education and the research-oriented education Utilizing the administrative automation in different sectors of the school, the existence of the virtual education Enhancement of learning pace and utilizing the information and communication technology.</p>
<p>The difficulties and challenges from the authorities of the schools</p>	<p>The rules and regulations, the course contents, the role of students, the teachers and the parents and education Support in the staff of the ministry of education and the lack of a cohesive and integrated plan</p>
<p>Experts Comments</p>	<p>Summary of the findings of the executive groups are listed as follows: The main concern of the directors is the executive plans and how they are performing and the lack of a comprehensive and long-term planning from the authorities in charge. By the implementation of this plan, the transformation of the educational system is a necessity and requires a new and cohesive framework and it has to get started from the lowest grades of the primary school. But, the beginning of the movement is from the high school, although there are no essential rules and strategies of the continuation of this process and will not lead to the creation of the smart schools with the defined objectives.</p>

8. Smart Schools Features in Iran

The school is trying to help new technology learning difficulties such as problems related to lack of computer literacy, information literacy, teaching and problems associated with the traditional methods. So the content is provided in an electronic form and the teacher is a guide. According this research “A Model the Success of Smart Schools Emphasizing the Role of Information Technology” the following can be noted as other features of these:

8.1. Curriculum

In total, the smart school curriculum promotes holistic learning and creates opportunities for student achievement and talent and at the same time concerns the interests and needs of the students (Attaran, 2011). Therefore Curriculum in smart schools should be meaningful. Comprehensive curriculum, creates an opportunity for all aspects of human intelligence and help students to see the connections between different subjects. In addition, the smart school curriculum is aim-centered and the objective is that all students develop their critical skills and knowledge they need to live as a citizen (MME, 1997B).

8.2. Evaluation

Smart Schools' evaluation system is flexible, familiar and easy to use for learner. Evaluation of students in such schools is done every day, consistently, on line and on distance and Parents can also be connected with thereby informed of the status and progress of their child's education. Smart school evaluation system should be such that provides a more accurate picture and a comprehensive evaluation of the performance of the students. the schools is the realization of the philosophy of education, therefore, a comprehensive and accurate picture of the performance of students is required. The smart school have been, teachers, students and parents have online access to the evaluation questions. In this system, teachers, students and parents can access to various parts of the evaluation via the Internet (Madras, 2011).

8.3. Content and Learning of the Curriculum

Smart schools need new content, well designed and innovative methods of teaching for teaching and learning. Such programs will supply the needs of students with different abilities, and thus reveals capabilities and give the opportunity to students to accept more responsibility for managing and directing their own learning. Teachers in such schools can use databases and software programs and other new courses designed to suit the needs and interests of students and change or modify the content of the courses in the schools. Therefore, the learning content will be somewhat different from other schools.

8.4. Teachers

As the Malaysian smart school project team stated, teachers' professional development is crucial to the success of smart schools. Training teachers need to use information technology and its integration with classroom activities to enhance thinking and creativity of the students. At the same time, teachers need to be smart in order to facilitate and encourage students to learn better, and in the long term, they need to increase their skills for the use of technology in education (MME, 1997A). The role of teachers in such schools is largely changed from teaching and evaluation of students to track their personal training and thus the opportunity and more time to address their professional growth and development programs (study, constructive communications and interactions, promoting their knowledge and teaching skills and ...). So for the effectiveness of the plan smart schools need trained and skilled teachers and administrators and well-designed processes to support themselves (MME, 1997B).

8.5. The Success factor of Technology at School Level

The Success factor of Smart Schools Emphasizing the Role of Information Technology .Technology has diverse roles in smart schools; such as teaching and learning process to help manage the schools. According to research findings, equipping schools include the following:

- Management room with the ability to manage databases and students' facilities, track student and teacher performance and the distribution of leaflets and other electronic information;
- A studio with a centralized control room for audio-visual equipment, video conferencing Chamber, workout sound and image studio;
- Teachers' room with online access to lesson plans and detailed content of each subject and databases, information and resource management systems, advanced communications too s, such as e-mail;
- Server room equipped to access applications, database management and network servers, security, telecommunications and access to network resources (MME, 1997A).
- Classrooms with multimedia courseware and e-mail for teamwork;
- Library or Media Center multimedia software with a central database for studies and network resources such as access to the Internet;
- Computer laboratory and audiovisual equipment;

The following sections provide information related to the final proposed framework shown in Bello figure:

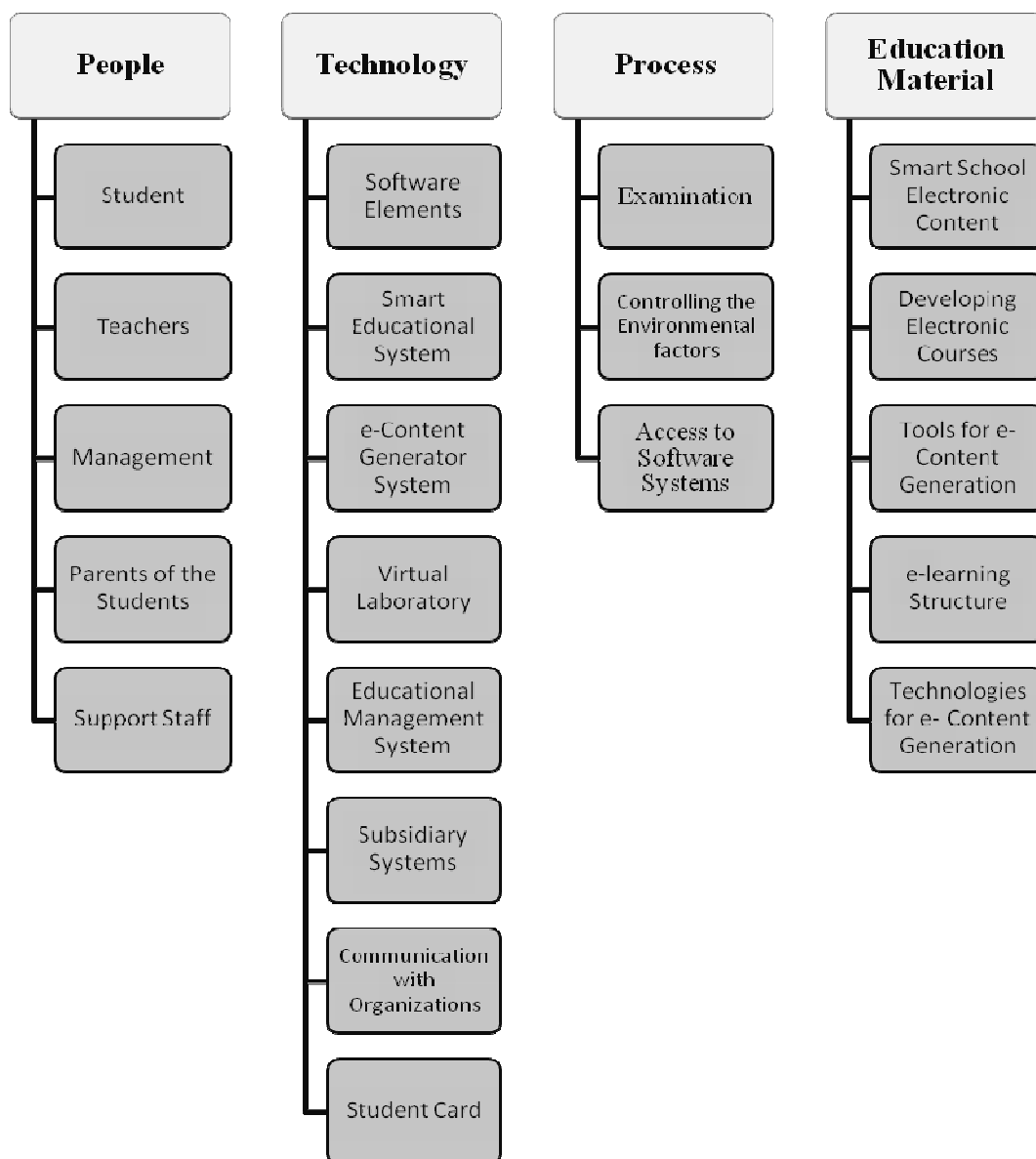


Figure : Proposed IT framework for smart school system of Iran

9. Results of the research

According to research findings, the model of business information technology value in the intelligence of schools has four main components that their relationship with each other and the concepts of theoretical propositions were determined. The results showed that the intelligence of schools is based on information technology and the impact It is very important, but not enough. Information technology in the learning and learning process, the intelligent chain, content production, infrastructure of the school network, multimedia tools, software applications, virtual education, IT service management is widely used. Awareness on smart school. Evidence also suggests that the use of technology and communication has reduced learning time, facilitated learning and education, increased learning accuracy, and reduced school spending. Therefore, the share of information technology in the process of learning and education is significant and if education of the phenomenon of intelligence in the process of converting traditional schools leads to the promotion of educational activities and agility and development of smart school. Accordingly, the school's intelligent school success model has four main components of technology, people, teaching materials and learning, and the electronic process, and includes the dimensions and success factors in intelligence at each level of intelligent schools can be used. Therefore, the role of technology components includes the intelligence dimensions that relate to all school activities, including software, hardware, network infrastructure, and security that faces the smart school network and is consistent with the globalization of education.

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