

A Comparison of Smart and Traditional Schools in Enhancing Learning Physics: a Study of Third Grader Girls of Experimental Science in Shahryar High Schools

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Abstract: The present study attempts to compare smart schools and traditional schools in terms of improving physics learning skills among female students of third grade in experimental science in Shahryar high schools. In terms of its objective, this study is an applied one, while it is a descriptive study with causal-comparative design in terms of data collection. The statistical population consists of 142 high school third grade girls who study experimental science in smart schools (Hazrat Zeinab and Farzanegan) and traditional schools (Hazrat Masumeh and Parvin Etesami) in Shahryar in the academic year 2012-2013. The statistical sample includes 100 girls in third grade (50 studying in smart schools and 50 going to traditional schools), selected using convenience sampling and sample size formula. The data were gathered using student scores in teacher-designed physics tests for the second semester of 2011-2012 and the first semester of 2012-2013. The data were analyzed through inferential and descriptive statistics, and one-way analysis of variance and Tukey's post-hoc tests were used to compare mean physics scores for students in smart and traditional schools. Our findings suggest a significant difference between physics scores of third graders in smart high schools and those of girls going to traditional schools. The results indicate effectiveness of smart education systems in promoting learning among third grader girls in high schools of Shahryar.

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1. Introduction

Knowledge and technology have changed the form of life on the planet in a way that it is now almost impossible to think of life without technology in the twenty-first century, an era which requires computer skills and knowledge for most jobs. This calls for a new form of education which cannot be implemented through the traditional means of education, particularly those currently found in Iranian schools (Mortazavi & Movaqar, 2011).

Furthermore, current limitations on electronic systems used in basic educations dictate application of suitable technologies based on the existing infrastructure and current conditions. Significant advancements in communication and information technologies and their vast applications have led many organizations and governments to large investments in such technologies. As such, effective management will depend on effective investment in communications and information technologies.

Smart schools adopt a new approach to education which combines IT and curricula in order to bring substantial changes into teaching and learning processes. In this approach, teacher acts as a guide rather than someone who merely communicates knowledge while students act as creative actors who actively engage in learning instead of passively

consuming this knowledge, and appraisal systems are process-oriented instead of result-oriented ones (Garison & Anderson, 2000).

The ultimate objective of establishing smart schools is to equip students with computer skills and literacy required to meet the requirements of the twenty-first century. If the goals of e-learning are defined as facilitating learning process, focusing on individual potentials, preparing the stage for learner growth, creating time- and place-independent means of learning, developing life-lasting education, improving education quality, and finally using all effective means of learning, then education agency will be the best target for realizing these goals particularly in Iran with its large student population, suitable infrastructures for growth and development, and young population (Alirezayi, 2008). Smart schools are among the most important achievements of IT developments in educational programs with advantages and effects that will go beyond the education environment to provide students with new experiences and access to unlimited information (Taleqani, 2010).

Our young society needs smart schools since the growth of computer technologies has provided everyone with easy and quick access to vast amounts of information which were often unavailable in past schools where teachers passed information, knowledge,

skills, and values of their choice to students. Today, economic and socio-cultural frameworks together with mass communication tools play an important role in shaping student perceptions (Moayednia, 2005).

This enhances standard level of student knowledge and with training courses left behind, IT and informatics used in smart schools will be quite helpful in updating teachers' knowledge and enhancing their teaching skills by making use of the existing resources, gaining a more accurate understanding of students knowledge, and developing courses and their contents based on this level of knowledge (ibid).

On the other hand, the information society of the future will require people who can creatively use IT to promote growth and development. In this era, lack of up-to-date knowledge, understanding, and skills will result in unemployment and social inequality, thereby leading to tension and dissatisfaction. Smart schools are usually designed based on these requirements as students at these schools can learn how to extract the information they need from information networks, how to interpret them, and how to apply their findings to solve their problems and to help the development of their society (Alirezayi, 2008).

Many problems faced in IT development in Iran, including lack of cultural packages, insufficient skilled human resources, unfamiliarity with foreign languages, low levels of research motivations and morale, lack of practicality, and in one word, lack of life skills, stem from inefficient traditional education system which cannot meet the requirements of an ever changing society (ibid).

Iranian education system is still largely based on books, and students are required to memorize the contents of books in order to pass their courses. The teaching approach is still a teacher-oriented one, leaving students with only a minor role to play in teaching and learning processes. Therefore, greater emphasis must be made on education and on reinforcing stable and lasting infrastructures for e-learning. Smart schools can create significant changes in the education system. Research Hypothesis: There is a significant difference between smart and traditional schools in terms of improvement in learning physics.

3. Methods

In terms of its objectives, the present study is an applied one that seeks development of knowledge applicable to education. The study is a descriptive one with causal-comparative design in terms of the data collection method as the researchers used the dependent variable (improved learning capabilities for physics) to examine the dependent variable (creating smart schools).

The statistical population consists of third grader girls studying experimental science in two smart

schools, namely Hazrat Zeinab (49 students in two classes) and Farzanegan (23 students in one class) and two traditional schools, namely Hazrat Masumeh (36 students in one class) and Parvin Etesami (34 students in one class) in Shahryar in the academic year 2012-2013. In total, 142 students -72 students in smart schools and 70 students in traditional schools - were studied (Shahryar Education Department, 2012).

Convenience sampling was used to create a sample of 100 students in third grade of experimental science in Shahryar (50 students from smart schools and 50 students from traditional schools). The following formula was employed to determine the sample size:

This formula is used for one-way analysis of variance or in studies where the measurement scale is an interval scale (Human, 2005).

To calculate sample size using the formula above, one needs the variance σ^2 . For this purpose, we performed an initial evaluation of physics scores of 20 students from smart and traditional schools in order to obtain an initial estimation of the variance and select the final sample. The table below shows the results of this stage.

Standard deviation	5.4
Standard error of the mean	1.148936
Alpha level	1.96
D-value	2.251915
Sample size	49.7448

By substituting the values indicated in the table above into the sample size formula, we get a sample size of 50. We used simple random sampling to select individuals by drawing lots.

4. Results

The idea of using computers and the internet at schools and academic communities dates back to early 1960s and twentieth century. England was among the pioneers in establishing smart schools and using IT as a part of its nationwide education plan. The country rapidly implemented research and practices for reforming training methods and educational approaches, course subjects, and curricula, and adopting more effective learning approaches.

England quickly understood the requirements for ITC and its application to innovations in education and promoting effective methods through establishment of smart schools. The country claims that these schools are helpful in achieving education goals in an effective and stable manner.

Perhaps, other factors such as quick and easy access to implementation tools and systematized schools play a role too, but it should be noted that movement toward smart schools is inevitable and

therefore effective mechanisms must be developed to supervise and assess establishment of smart schools in order to ensure a balance between powers and responsibilities of smart school staff and to move toward a more dynamic and novel approach to educational development (Saeid Zand Vakili, 2011).

Smart schools represent a development in school architecture (*i.e.* structure, culture, role, *etc.*) and moving toward organizational learning and promotion (creating a learning organization) which contribute to changes in learning-teaching approaches by promoting creativity, research, and critical thinking in a knowledge-based nationwide education system, and to transition from memory-based approaches to research-based ones and from teacher-based methods to student-based one for creating a dynamic and attractive environment which helps actualization of potentials and collective and individual creativity by facilitating development of knowledge and technology across the society and the education system.

Furthermore, new technologies (*e.g.* ITC) provide opportunities for improving education quality, access to learning and teaching opportunities, and enhancing scientific capabilities and skills among teachers, parents, and members of society (Mashayekh, 2000).

Using their flexible curricula, novel teaching methods, and a broad range of programs and learning methods, smart schools focus on the role of students and their individual differences, needs, interests, and capabilities to effectively bridge the gap in the education system.

The information society of future requires people who can creatively use IT for growth and development. In this era, lack of up-to-date knowledge, understanding, and skills will result in unemployment and social inequality, thereby leading to tension and dissatisfaction, and therefore, human societies of today need human development more than ever before (*ibid*).

Samadi and Nemati (2010) argue that smart schools are often designed to meet planning requirements since in these schools, students learn how to obtain the information they need from information networks, how to reflect on this information, and how to apply them to solving problems and moving toward development and progress.

Arefi (2010) notes that a smart school is a fundamental step toward correct and effective training for making pre-planned use of knowledge and technology by learning meaningful techniques, thinking, and setting goals for life in order to assist students to draw on their real social capital to successfully prepare for a global competition by the help of electronic systems, smart supervision, and intelligent appraisal system which improve learning efficiency in students

5. Discussion

Theoretical definitions variables

Smart school is a school where all processes including administration, management, control, teaching, learning, development of educational materials, appraisal, office documents and supplies, and communications and their developments are based on IT in attempt to promote research-based education system. In other words, smart school is a school which, in addition to physical facilities and programs used by other schools, applies computer equipment and related technologies to control and manage the school; the content of most courses are in electronic form and smart systems are used to assess and supervise the system. In such schools, the system is installed on a central computer which is connected to many phone lines to provide 24/7 service. The system enables students, parents, teachers, and school employees to interact on a continuous and dynamic basis (IT and Statistics Center, 2011).

Learning is a process of relatively stable and experience-based changes in potential behavior of individuals (Hilgard & Marquis, 1961).

Learning enhancement consists of general or special knowledge or skills acquired for learning course subjects, often measured through tests or indicators, or both, set by students (Shoarinejad, 1985).

High School Education System in Iran

The existing education system in Iran is a relatively new social and educational phenomenon which is over one decade old. The Iranian Ministry of Education's proposal for new high school system was approved by High Council of Cultural Revolution in 1990 and the plan was launched on experimental basis in different regions of the country in September 1991. The timing and stages for implementation of this new system were defined in the General Education Framework:

- (1) In 1992, the new system was tested for the first grade in all majors.
- (2) In 1993, the new system was launched for first and second grades in all majors.
- (3) In 1994, the new system was tested for first, second, and third grades in all majors.
- (4) In 1995 to 1997, the system was gradually developed into a uniform system for all high schools in the country.
- (5) In 1998, a program was launched to implement pre-university, associate degree program, and public education in a broader scope, and finally in the academic year 1999-2000, most high school students were covered by the new program (Vista e-Zine, 2011).

In this section, we discuss the reasons put forth by the High Council of Cultural Revolution for implementing the new education system for high schools:

- (a) To provide sufficient resources to improve quality of high school education (theoretical, technical, and vocational) and to develop the system based on economic, social, and cultural needs of the country, geographical features, course materials, and gender and age-based needs of students;
- (b) To create flexibility in high school orientation for useful employment or continuing education, and to determine majors based on the country's requirements and individuals' interest and competence while taking into account the existing conditions and scientific and technical advancements;
- (c) To improve quantity and quality of technical and vocational training; and
- (d) To set the stage for optimal use of available resources in high school education and organizing out-of-school training and promote education by making use of resources available to authorities. High school education system in Iran is divided into three branches: theoretical, technical and vocational, and theoretical-practical training (ibid).

The major goals of each branch, which indicate employment or education orientation, can be summarized as follows:

Theoretical branch: the courses in this branch are intended to promote culture, general knowledge, moral virtues, political and social vision, and better understanding of students' potentials and interests in continuing education.

Technical and vocational training: this branch seeks the same goals as the theoretical branch in addition to directing students toward useful employment and preparation for continuing education in scientific or applied (technological) majors.

Practical – theoretical training: in addition to the goals of theoretical and vocational training, this branch seeks to educate human resources at semi-skilled, skilled, and professional levels for industries, agriculture, service sector, and preparing students for continuing education in applied and scientific majors (Vista e-Zine, 2012).

One major goal and function of education system is to prepare students to grasp and understand scientific changes of the future world. However, the most important goal of this system is to fully actualize student personalities and values. Social and emotional development of students is closely linked to cognitive aspects and even to educational progress. According to Bloom, any student completes learning a subject with a set of its affective features. Therefore, educational planning and practical programs require close attention

to special quality and results of each method (Kadivar, 2003).

What is a smart school?

Broad applications of information and communication technology (ICT) into education together with recent development in global educational approaches have led to formation of smart schools which are among the key requirements of today's knowledge-based societies and seek to develop entrepreneurship and knowledge-based skills among students (Ministry of Education, Tehran Department of Education, 2011).

At these schools, teaching-learning process is promoted and an interactive environment is developed to enhance students' key skills by focusing on group activities in a knowledge-based era. The current teacher-based conditions in the education system of the country call for updating school systems, using state-of-the-art technologies, and applying innovative approaches to education while focusing on students capabilities. The term "smart school" has been recently introduced into education literature in Iran and several valuable, and yet scattered, works have been carried out in this area. Inspired by the religious teachings and current requirements, the Ministry of Education has drawn on international standards and local requirements to define a meaningful structure for developing smart schools in order to realize the goals defined in 2025 Vision Plan as well as the goals set by the education system in terms of promoting educational equality. Iranian Fifth Development Plan requires the Government to realize educational equality and facilitate the existing processes by making use of ITC in training courses and in educational processes (ibid).

According to the existing documents, a stand-alone program was developed for IT sector of development plans in 1972 with IRR 470 million fund as well as in the Second Development Plan which was not implemented to due Islamic Revolution. In post-Revolution period, the First Development Plan did not emphasize the importance of IT. Although a High Council of Informatics was established and found legal status after the Revolution, however, the Second Development Plan addressed the goals and policies for IT development and its applicable programs only in a limited manner (Ebadi, 2003).

In the Third Socioeconomic Development Plan greater importance is attached to IT which then found a more proper position in the proposed plan that focused on the requirements for new attitudes, application of IT to all areas, reviewing previous performance, identifying the current conditions, problems and issues, structural strengths and weaknesses, and analysis of the existing IT performance (ibid).

An important aspect of the Educational Development Document is greater attention to ITC as a facilitating factor. EDD regards ITC as an important factor which catalyzes optimal education and can serve as a starting point for movement toward a modern education system that underlines research and innovation (Planning Council, Ministry of Education, 2007).

EDD refers to recent civilization changes and new professional requirements which call for use of ITC and fundamental modifications in the educational materials and methods of managing schools. In addition, stakeholders will be given a new role and students will have a more prominent role in their own learning as they must be allowed to choose their growth path based on their interests and to develop their creativity, capabilities, and abilities to create and manage information (ibid).

Smart Schools: a World History

Although used in different ways and to refer to different concepts, the term “smart school” found its first broad application in 1997 in Malaysia as a tool for assisting students to prepare for the new information age and to make fundamental changes in Malaysian schools (Attaran, 2011).

The first smart school was established in England in 1996, followed by a similar motion by Malaysia that defined a basic project for establishment of smart schools within its development plan. In 1998, Malaysia became the first country to launch a smart school within its education system which set a successful model for other countries like France that successfully followed Malaysia.

The advent of data processing systems and their development over three decades paved the way for computers to enter many social and individual areas, and in 1990s many countries equipped their schools, even the elementary ones, with computer tools. The advent and development of computer led to establishment of computer networks and the emergence of the internet (Tehran Department of Education, Ministry of Education, 2011).

The idea of using the internet and computers in schools and academic environments dates back to the twentieth century and early 1960s. The internet emerged in 1969 and grew rapidly beyond anyone’s imagination to serve 180 million users in 2000. The fast growth continued to cover about 500 million users in 2003. This rapid development in IT together with other factors such as transition from industrial society to information society, demographic changes, globalization of professional activities, growth of labor market in the education area, or in other words commercialization of education all played a significant role in education.

Smart schools in Iran

Over the past few decades, the scope of education and learning has grown just like academic, cultural, economic, and social activities inspired by rapid developments in technology and emergence of satellites, computers, and the internet.

Application of technology to Iranian education system dates back to the use of audiovisual education aids including slides and films at schools. Later, TV received attentions from education society and Iranian National TV formally launched programs for public nationwide education.

Following the introduction of computer industry to Iran and penetration of PCs among different social and cultural communities, computer-based education started to grow by introduction of training CDs in about ten years ago. In general, it was not until 2001 that computer-based training was taken seriously and operational activities began in internet-based education and using communication bandwidths to offer training courses around the country. In 2004, a smart school project was launched for the first time for development of ITC in education system (Tehran Department of Education, Ministry of Education, 2011).

The draft of Smart School Strategic Plan defines smart school as an educational organization with a physical, as opposed to virtual, environment where students can learn using novel education tools. In a smart school, control and management is based on computer and network technology, contents and materials are often in electronic format, and a smart system is used for appraisal (Tehran Department of Education, 2005).

In the academic year 2004-2005, Tehran Department of Education was assigned implementation of a pilot smart school plan in 4 high schools. According to official statistics, in September 2011, over 120,000 schools were running in the country and about half this number were operating as educational complexes (Tehran Department of Education, Ministry of Education, 2011).

Characteristics of Smart Schools

In smart schools, blackboards are replaced with computers and notebooks are replaced with CDs. Students can obtain large amount of information on any subject from the internet. In such a system, student and teacher both contribute to the electronic materials and present the courses in CD formats. In smart schools, teaching is not limited to teachers; rather, teaching and learning occur in an interactive way and students play a fundamental role in learning practical subjects (Sadeqimoqaddam, 2008).

Teachers in a smart school use electronic materials to improve understandings and save time and

students are given opportunities to exhibit their capabilities and create contents. Instead of trying to find answers to students' questions, teachers in smart schools ask students for finding the answers using computers and then communicating these answers to other students.

Smart schools are "student-oriented" schools where teachers merely direct and leave the choice of materials to students. Parents can communicate online with school teachers and principal and get information on the progress of their children. Libraries of smart schools are electronic libraries that can be accessed online by students. Online discussions and threads are also accessible online (ibid).

One can summarize the characteristics of smart schools as follows:

- (1) Creativity
- (2) Novel learning methods
- (3) Focus on understanding
- (4) Exchange of information
- (5) Centralization of learnt materials (Mehri, 2012)

In a smart school, learning stems from thinking and a good idea can be learnt by all students. Schools are places which help students grow and smart schools provide this opportunity for administrators and teachers as well.

Structure of Smart Schools

Establishment of smart schools requires a long-term plan. For example, a smart school established today may need more than 10 years to complete changes in terms of communication infrastructures, suitable materials, teacher training, training methods, and parent culture. These schools differ from the traditional ones both in physical form (*e.g.* arrangement of seats and classrooms) and architecture. Classroom spaces should be designed in a way that provides students with a laboratory next to their desks. On the other hand, teachers of smart schools act as guides who should engage students in learning relevant materials. This training method helps students understand materials both theoretically and practically and teach the students ways to access information when they encounter a problem in future (Sadeqimoqaddam, 2011).

Structurally, smart schools consist of four general sections:

Education: systems for managing and developing education materials

Administration: administrative and financial automated systems as well as systems for registration, teaching fees, payments to staff, *etc.*

Control: physical security and attendance check for human resources

Community: participation of stakeholders, parents-school relations, and web-based procedures

Advantages of Smart Schools

- (1) Giving back teachers their position as academic references and education guides
- (2) Using computers as teaching aid and for better communication of materials
- (3) Institutionalizing administrative automation in all activities
- (4) Decentralizing local decision making processes
- (5) Resolving problems related to lack of administrative staff
- (6) Basing decisions on fundamental thinking
- (7) Assisting families in using computers
- (8) Increasing productivity in application of technology into educational and other forms of activities (ibid)

Disadvantages of Smart Schools

- (1) Digital information gap between teachers and students
- (2) Lack of skills among colleagues
- (3) Lack of professional users in schools
- (4) Absence of proper technology models in schools
- (5) Poor decision making due to lack of knowledge on IT
- (6) Insufficient cultural infrastructures to develop technologies for teachers and other persons
- (7) Adverse effects of websites on moral and religious identities
- (8) Lack of necessary skills for technology management and using information systems
- (9) Inconsistencies between smart schools and traditional schools

A smart school is not simply a tool or hardware; rather, it is a progressive idea for facilitating learning and teaching processes (ibid)

Smart text messages

Smart Schools vs. Traditional Schools

In traditional schools there are several limitations, particularly in terms of access to information since students only use textbooks and have access to limited knowledge of teachers. There are also limitations on physical environment and educational resources which lead to other forms of limitations, while many of such problems are resolved in smart schools through various networks that provide access to information (Tehran Department of Education, 2007).

It should be noted that smart schools differ from traditional ones in many ways. In smart schools, course materials are often developed based on students' capabilities and therefore, there may be, for example, 40 different training approaches for a class with 40 students in order to provide more capable students with more opportunities to use the materials and to help the less capable ones catch up with others (Jalali, 2009).

Automated education system and voting and assessment of each student's condition are among other major differences between the traditional and smart schools. Such systems may be used to promote parent roles in guiding students. Thus, when we speak of a smart school we mean, in fact, a school where there is a different system for each student to teach students how to gain access to global information without needing help from others (Zabeti, 2009).

Here we summarize the differences between smart schools and traditional ones. In traditional schools

- (1) Students learn and teachers educate;
- (2) Curricula are limited (to textbooks and prescribed notes);
- (3) Teaching method is teacher-based (knowledge and information);
- (4) Data are exchanged slowly;
- (5) Chalks, blackboards, and scores are used as training aids (overworked materials);
- (6) Research organization develops course contents;
- (7) Classrooms are not active (students are passive);

- (8) Creativity and theorizing are limited;
- (9) Supervision and assessment of education and trainings are relative;
- (10) Parents have limited engagement;
- (11) The focus is largely on information and knowledge;
- (12) The whole class constitutes one single group;
- (13) Teaching is based on notebooks, assignments, textbooks, and so on; and
- (14) Verbal approaches dominate the teaching process (Smart Schools Secretariat, 2011)

Descriptive and Inferential Findings

An explanation of hypothesis is presented in this section, followed by the results of the statistical tests presented in SPSS tables as well as discussion on the findings.

H_1 : Smart school and traditional schools differ in terms of promoting learning physics.

H_0 : Smart school and traditional schools do not differ in terms of promoting learning physics.

Table 1: Mean and standard deviation for Physics II and III scores in smart and traditional schools

Type of school	Course	Mean score	Standard deviation	N
Smart school	Physics II	12.9000	3.77593	50
	Physics III	11.9850	4.14175	50
	Average	12.4425	3.96972	100
Traditional school	Physics II	17.0600	1.79821	50
	Physics III	17.8000	1.75109	50
	Average	17.4300	1.80455	100

As seen in the table above, average scores for Physics II and III in traditional schools are 12.90 and 11.985, respectively, while the respective values for smart schools are 17.06 and 17.80, with an average of 12.4425 and 17.43 for two subsequent semesters for Physics II and III in traditional and smart schools,

respectively. This obviously indicates a 5-point difference in favor of smart schools. One-way analysis of variance was used to determine whether these differences are statistically significant or not. The results are presented in Table II.

Table 2: Sources of variance, mean of squares, degree of freedom, and statistical significant level

Source of variance	Sum of squares	Degree of freedom	Mean of squares	F	Significance level (α)
Intergroup	1,278.378	3	426.126	45.198	0.001
Intra-group	1,847.871	196	9.428		
Total variance	3,126.250	199			

Given the value of F (45.198) in the table above, the difference is significant at 0.001 with the degrees of freedom 3 and 196. More specifically, the difference between smart and traditional schools is significant at 0.001, indicating the prominent role of smart schools in enhancing learning physics. The following table presents the differences between the two types of schools in terms of physics scores. This table complements the previous table. In other words, the table above only shows the differences in average physics scores while the following table which is based on Tukey's test indicates differences in Physics II/Physics III as well as the differences in individual semester scores. Table IV contains more details.

Table 3: Tukey's post-hoc test

Type of school	Course i	Course j	Mean difference (i-j)	Significance level (α)
Traditional	Physics II	Physics III	0.9150	0.445
Smart		Physics II	4.1600	0.001
Smart		Physics III	4.9000	0.001

As seen in this table, there is no significant difference between mean scores of Physics II and Physics III in traditional schools ($\alpha=0.445$) while average Physics II score of traditional schools is significantly different from average Physics II and III scores in smart schools ($\alpha=0.001$) by more than 4 points.

Table 4: Tukey's post-hoc test

Type of school	Course i	Course j	Mean difference (i-j)	Significance level (α)
Traditional	Physics III	Physics II	0.9150	0.445
Smart		Physics II	5.0750	0.001
Smart		Physics III	5.8150	0.001

In addition, average Physics III score of traditional schools is significantly different from average Physics II and III scores in smart schools ($\alpha=0.001$) by more than 5 points.

Table 5: Tukey's post-hoc test

Type of school	Course i	Course j	Mean difference (i-j)	Significance level (α)
Smart	Physics II	Physics III	0.7400	0.624

On the other hand, there is no significant difference between Physics II and Physics III scores in smart schools ($\alpha=0.624$).

Recommendations

Based on the findings of this experimental study and the theoretical bases, education authorities are recommended to implement smart schools in order to benefit from its positive effects, and to prepare comprehensive and professional plans based on an appraisal of needs and requirements, preparation of infrastructures, and using experiences and models employed in other countries, particularly Islamic countries, to facilitate the movement toward a smart education system.

Directions for Future Research

- (1) Currently, there are some smart schools in the country but these schools employ primitive tools which are incomplete compared to successful implementations in other countries like England and Malaysia that are far ahead of our country in terms of smart school implementation. Iran effectively implemented smart schools only on paper and therefore, comparative studies are

needed to incorporate experiences of other countries and available research into making reasonable decisions.

- (2) Future research may investigate necessary trainings in terms of skill, attitude, and cognitive requirements in order to prepare staff for working at smart schools.
- (3) Research should also examine the types of educational environments and infrastructures required for smart education.
- (4) The scope of the present study is limited to Shahryar and its particular economic and social conditions. The study can be replicated to other cities and provinces.
- (5) We studied high school third graders who study experimental science. Other studies may cover other grades and majors.

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12/2/2013