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Exploitation of Green Schools, A Modern Solution to Economic Growth

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Abstract

It is obvious to everyone, that the students play future makers role in each country, therefore education is considered as a principle factor, to develop the country. Education areas play a vital role in economical developing and increasing the productivity of the country by considering as one of the most important human resource training factors. According to statistic data, increasing the energy consuming in Iran is five times more than the average of energy consuming in the world. Therefore, there is no doubt that by sustainable consumption, Iran economy can be developed in many aspects. In this case, improve the green schools in Iran becomes an important issue. This can be studied in different aspects: first, by using the principles of sustainable architecture in those schools, excessive consumption can be prevented; also, the green fuel can be substituted to fossil fuel. Second aspect, which is more important than the first one, is that students would learn different ways of sustainable life by educating in those schools. In this research, the authors according to their investigations and research evidences, first attempt to introduce the green schools from economic aspect and saving the environment recourses point of view. Then all the supplies and recourses, which are required to design these schools, are explained. By studying international and national experiments in this field, they published their research results in this paper. At the end regarding to practical development of this technology, they explained some of the most practical solutions to build green schools in Iran.

Keywords: economy, education, solutions, green schools.

Introduction:

Although there is no simple definition for development and many scientists and researchers still work on it, many experts believe that human is the main aspect of the development. It is obvious that human being become human by educating and learning different things, therefore education in human life is as important as human, and it can be considered as human machine building. This machine interacts with different factors, which relate to development. In other words, in order to have economic, political, social, cultural and ideological progress, improvement in education is inevitable. In a research, which took one hundred and ten years (1850),thirty-four rich countries are investigated. The results showed in the countries, that public elementary education is considered more important than economic development, therefore they developed their economy by developing their education. (Bozorgi and collogues 1384).

Educational economy consists of two main words, economy and education, which refers to economics (in economy field) and ethics science (in education field). However, this compound science considers the application of economy in education field, and high quality education - by using economic solutions -. In addition, economy makes education capable of teaching humans in better ways; therefore, they can be more effective for human resources and their society in different aspects such as environment, hygiene and nutrition, job market, political and economic freedom. These resources play a vital role in frequently chain of society resources and use them to reach development and salvation. Resources also make society capable to gain sustainable development and use its own national culture in all society's dimensions. (Sarraf 1383).

Modern developments are considered as a link between education and economic growth, which is related to environment and school. They all focus on social development. It is expected that modern schools to be flexible and capable to adapt to any new application. (OECD 1996).

In the future of the advance world, educational buildings have to adapt themselves to remarkable changes of the future social and educational areas. During the recent decade a vast change in educational area standard design, which is included the new plan for education and new educational methods has occurred. Many schools consider a set of education rules to teach saving the environment, and energy resources methods. In addition, in recent years, educational and learning methods are changed a lot; also new technologies improve the educational equipment. (Heppel et al. 2004). Those elements that are mentioned above should be considered during the physical design of an educational area.

Since educational issues and building an educational complex are complicated and multidimensional, the knowledge of many experts is needed in a systematic organization. Those dimensions are such as skeletal and spatial, visual and perceptual qualities, aesthetic, environment and territories, technological issues, etc. (Ghafari 1377). Educational environment should provide all the students' requirements that are changed frequently with educational patterns. Since technology improves every day, the students and teachers' requirements change frequently as well. Educational area has to be flexible in order to provide all the educational requirements during the time. It is possible to investigate schools and educational area's flexibility pattern in different dimensions. In macro-scale view, it is tried to combine elements and other performances to provide a subjective favourable feature that helps students to feel more belonged, identity, self- confident, and proud. In intermediate scale view, elements such as the number of floors, different kinds of communications in educational area should organized in order to adapt new and dynamic educational methods and rapid technology improvement. In micro – scale view, choosing a proper shape and frame for educational elements and their details are considerable. These choices should provide a positive feeling in each student in different times and situations. (Mahmudi and Nikghadam 1391).

In all around the world, in1970s energy crisis started, therefore sustainable term introduce to the worldwide knowledge. It includes three effective regions, which are, social ethics, environment resources and skill design in development field. Idea and attitude of sustainable architecture design tries to make architecture compatible with environment. Sustainable term first was introduced by international

committee of environment in 1986. They explain it as an encounter with demands without damage next generation resources. This term has an increasing procedure in its dimension and domains, and this improvement can demonstrate proper strategies for people from all around the world. Nowadays, architecture is considered as a super system. Architecture has a high responsibility, because 50% of the world energy consumption or waste energy relates to this field. (Ghorbani and collogues 1392). Green architecture originates from sustainable architecture and development, and this is happened because, human requirements encounter with the distractive effects of industrial and consumable society. Many issues such as saving the environment resources, immunity from air pollution and other kinds of pollution, saving the Ozone layer, physical and mental hygiene, future of humanity, etc. are considered in this field. Therefore, the necessity of the green architecture becomes obvious. Green buildings are capable to control the energy consumption and saving natural resources. Since one of the most important buildings, which are built in cities, are educational areas and schools, green architecture attitude can be very useful to design schools in an optimized way to consume less energy and save the environment. In addition, try to teach these effective aspects to students. On the other hand, although improve the culture in environmental field and saving energy resources is one of the most important factors in environmental preserving, unfortunately in macroeconomic policy of Iran this issue is not paid attention. Without paying attention to education, it would be impossible to preserve environment and energy resources, and founding a massive building without considering preserving culture would not be reliable. In Iran generally environmental preserving and saving energy resources attempts only act as an alleviation. These attempts would decrease bad effects of destruction temporarily, or in the worst case, they would lose their effects because of the lack of culture. As it is mentioned above, improve the roots of the culture in educational field for a society is vital. (Ijei 1389). In order to preserve environment, it is necessary to pay attention to green buildings, and how they can be useful for next generation. These things achieve by effective education. (Safari and Mahmudi 1390).

According to this literature review, although many researchers have devoted their times in educational economic field and green buildings, green schools and green buildings issue and even more important than that, the effect of these schools in Iran education is not considerable. Therefore, the authors of this paper have attempted to demonstrate the importance of green buildings and their effects on education, consequently to have economic development and use this technology to gain benefit in Iran. At the end, some practical applications are surveyed to gain benefit from this schools in Iran.

In this research paper, according to Iran economic barriers and issues, authors have attempted to explain the green schools definition, characteristics of green schools, describe the material which are used to build them, different technologies that are used to reduce the energy consumption, different green schools' factors, worldwide experiences for this technology, does Iran be successful to use these schools. At the end, some practical applications in order to develop the Iran are discussed.

Main Context

Green School Definition

United States of America Green Building Council (USGBC) defines green schools in this way: Green school is a healthy environment that causes learning and at the same time reduces the energy consumption, resources and expenses.

Green Schools Characteristics

School is the first social environments that human attend to it and improve his soul and character in there. The educational environment influences on the quality of education, students and teachers behaviour, therefore there is a tight relationship between architecture and education. It is very important to know how an educational building is built, because the educational architecture effects on spirit and body of students. Green schools term has become popular in worldwide, and even in Iran. Green schools are palaces where environmental characteristics are considered. These characteristics have two aspects,

one relates to human aspects such as employee, teachers and students who should commit environmental patterns. The second aspect is structural aspect such as environmental standards, which are considered in build a school. In green schools all members of the educational society, which include teachers, students, parents and teachers, try to gain experiences and skills for preserving environment and non-renewable energy resources. All the environmental standards and criteria would be considered to build these schools.

As it is mentioned before, making a healthy educational environment for students, in design procedure would be considered. In some green schools, the roof of the school is full of flowers. Design procedure of those schools is symmetric with energy consumption reduction and preserving environment. In green schools, water usage is reduced and the electricity is produced through renewable resources. Students of green schools will learn about plants (these schools are like botany class), how to preserve environment, and different saving energy methods. Definition of green schools and different kinds of green schools. (Unknown 1392). This is important to know that in these schools, the only issue is not to teach students how to preserve environment, reduce energy consumption, but also the effects of teaching these things to students, could improve the preserving resources and optimized consumption culture.

Green Schools Applications in Energy Consumption Reduction to Have Economic Development

Generally, green architecture depends on four main principles:

- Preserve water, wind, and other kinds of energies.
- Provide a healthy environment for everyone.
- Develop the economy in the country.
- Provide a high quality life for citizens.

Green Architecture Investigation

Before a green building is built, as same as other creatures, it requires a creative designer. Building a green building can improve the health quality of a person who lives in the building or his neighbours. In addition, this can protect the person and would satisfy him. This issue requires certain strategies in architecture field such as stable nature usage, high quality materials, use the solar energy to produce electricity, heating and lighting system, wastage reuse, etc. In order to have a sound and firm building it is necessary to have all these strategies as strategies union.

Wall's Color

Colors of the walls and the amount of solar energy that absorb by them have mutual relationship. By using different colors for exterior walls of a building, the amount of solar energy can be controlled. Light colors can reflex almost 85% of solar energy, whereas, for dark colors it is reduced to only 15% or less. In Ghorbani research (1392) the amount of energy that is wasted because of the lightness or darkness of the walls were measured and the results are shown below:

Coefficient absorption for light color is 45%

Coefficient absorption for dark color is 90%

Wall's Insulation

Energy would waste, because of the lack of insulation, from all controlled interior surfaces of the building that are connected to uncontrolled areas or exterior areas. These controlled interior surfaces include walls, roofs and floors of a building. In order to avoid energy wasting in heating and cooling processes in a building it is necessary to consider heating insulation in design and construct a building. Insulation can save a considerable amount of energy. The most important insulations, which are used in Iran, are: hard wool, fiberglass, slag wool, polyurethane, and polystyrene foams. In order to choose a proper insulation for walls and roof these factors should be considered: thermal insulation resistance, incoming forces, how it deals with fire and water absorption.

New Technologies in Optimization of Energy Consumption

Nowadays, in all around the world using sustainable architecture and build green buildings become an issue, because people in the world face with serious problems such as global warming, air and water pollution, excessive energy consumption, and its expensive economy.

Green Roof and Wall

Green roof is a lightweight and engineering product system that different plants can grow on it also it protects the roof. It has a greenish surface that consists of vegetative plants in the layer of soil, which is top of the roof. Green walls protect the building against ultra violet rays, rain and wind. In addition, they avoid dust to spread in the air.

Cavity Wall Façade in Optimization of Energy Consumption

There are several terms that have the same definition as cavity wall façade, which are listed below:

Two sheet façade, cavity wall façade, double façade, front double, cavity face glazing, ventilation wall face, ventilation face. Cavity wall façade can be defined as: a pair of glazed face side that are separated from each other by an air corridor. Usually the main layer of glazed is insulated. These air gaps between glazed layers act as an insulator against very high and very low temperature, wind and noise. Solar devices are usually settled between two face sides. All the elements can be organized by permutation and combination of different solid and transparent membranes.

Nano Technology in Building

Nano technology is one of the most recent technologies and effects on many fields that include buildings. Architecture science consists of new material details that each of them has its own properties therefore, Nano technology in architecture science still in its beginning steps and it would have a great future. This science open a new view in micro-scale by controlling different materials, this also cause other fields improvements. The achievements of this technology include production, transformation, consumption, and energy storage applications, which consequently cause of environmental pollution reduction and improve building performance. These achievements can be interpreted as a great revolution. Nano technology is a revolution in material production and devices that are proper for specific requirements. It is possible to build Nano blocks in certain size and combination with certain accuracy, and then put them in a bigger scale, which has unique characteristics and applications. This approach is considered as a revolution in material and productive processes. By Nano technology knowledge, researchers are able to produce some kind of materials that do not exist in nature and traditional chemistry were not capable to produce them. Some of the Nano materials benefits are considered as materials with lighter weight, stronger, programmable, reducing the maintenance expenses by decreasing the technical problems. New devices based on principles of Nano-technology and architecture is born. One of the applications of green buildings Nano technology is using Nano materials that are capable to prevent excessive energy consumption in building. Many architects tried to use special insulation, by deploying solar energy and air and water purification to reduce energy consumption.

Photovoltaic

Photovoltaic convert the solar energy to electricity. The origin of photovoltaic phenomena is based on electrons and holes of photons' light absorption, and then electrons and holes separation by deploying electrical field in a semiconductor material. Therefore, one of the best methods to storage and use the solar energy is photovoltaic plates.

Wind Turbine

Origin of the wind is a complicated issue. Since the sun radiation spreads asymmetrically on the earth, two poles have less thermal energy than tropical regions. In addition, temperature changes in land are faster than that occur in the sea. Therefore, lands can be cooler or warmer faster than seas. This global temperature difference creates a global system in thermal exchange that includes the gap between earth and atmosphere, and it is as same as an artificial roof. Most of the wind energy is in the upper layers of

the atmosphere, where the speed of the wind is more than 160 kilometre/hour. At the end, wind will lose its energy by friction with earth surface and atmosphere. In capable regions by using wind energy, other kinds of energies can be stored and converted.

Glass

Glass is one of the weakest parts of the building in thermal exchange. By reflex glazed advent, double plus glaze and inject special gas between those two glazed layers, thermal performance (low-c) of glazed in buildings improve considerably. Fortunately, nowadays immunity and safety of building glazed have been increased. They have become popular because of their thermal characteristics, the amount of light and heat that can passed through them, and reduce the amount of energy consumption in order to decrease the cooling and heating expenses. Since one of the main energy resources that is deployed to the building is solar energy that is transferred through the glazed, one of the most remarkable factors to choose a proper glazed is the amount of solar energy which is transferred by glazed.

Window

Make decision to change the windows of an old building or choose the windows of a new building are an important issue in energy consumption. In old buildings almost 30 % and in new buildings almost 15% or 20% of thermal energy wasting is occurred by windows. Window dimensions, window sealing, proper glazed for building and proper window frame influence on optimization of energy consumption. The best types of windows are the ones, which are wooden, aluminium, or P.V.C (P.V.C is made from vinyl), as they reduce the thermal waste and save the thermal energy, they are considered as the most efficient types. On the other hand, dimensions of the window effects on the energy consumption.

Insulation

Insulation plays a vital role to keep building warm in winter and keep it cold in summer. Insulation keeps building in winter 5 degrees warmer and 10 degrees cooler in summer. Consequently, it would reduce energy consumption and environment pollution. In addition, energy resources would be preserved for next generation. The most remarkable factor to choose insulators is their thermal resistance. The more resistance it has, the less thermal energy is passed, consequently increase the energy frugality. Therefore, instead of insulators thickness, the thermal resistance of insulators should be compared. Insulators with the same thermal resistance are capable to save the energy in a same way; the only difference of them is their costs and applications locations.

Solar System Heating

In each solar system heating which is used to heat the building area, three functions are expected:

1. Collect the solar energy (collection)
2. Store the energy in a capacitor (storage)
3. Distribute the energy in area (distribution)

There are two kinds of solar systems, which include active systems and inactive systems. In both of them three functions, collection, storage, and distribution of energy are occurred, but in different methods. Active solar system use mechanical devises to circulate the air or fluid through collectors and thermal capacitors. In addition, it requires a fan and pump to inject the stored thermal energy from the supply to the area. Active systems are complicated and they need exterior energy resources to perform. Inactive solar systems' performance does not depend on electricity or fossil fuel. It depends on natural thermal energy transformation methods such as thermal conduction, convection and radiation. In these systems, sun's rays first radiate the thermal absorption surfaces that are located in the southern side of the building, and then are stored in the gap space between the absorption surfaces and building. Finally, this stored energy is transferred to the interior parts of the building.

Construction of Trombe Wall

Trombe wall is a type of indirect absorption systems. In this system, energy is injected to work and life spaces indirectly. Therefore, unlike direct absorption systems in this system, desired amount of energy can be injected to area.

Nano Anti-sun intelligent glazed

In recent years, intelligent windows have developed stunningly. Electro-chromic intelligent glazed control the light and temperature at the same time. This glazed has an electron – chromic cover that consist of one layer of trioxide that reacts with voltage changes. This process changes the color of the glazed to a lighter or darker, which occurs by pushing a button or a sensor that increase the darkness of the glazed and prevent from infrared rays to absorb and make the interior area warmer. Consequently, energy decreasing happens, and cause cooling the interior area of the building. Increasing the darkness of these glazed is automatically and would return to its first state. None of the processes requires alternative electricity.

Criterions for Green Schools

The united States of America Green Building Council consider a school as a green school and allocate the LEED license to it if specific criterions are observed in order to preserve environment and reduce energy consumption.

These criterions to have green school are listed below:

Sustainable Sites: Choosing and preparing a site for a school because area, budget, restrictions is a challenging issue. In green architecture two elements are remarkable, first, control the erosion, dust, and to be far from any building activity which cause pollution. Second, consider the region and environment of the site.

Water Usage Efficiency: This criterion is all about necessity of reducing water consumption. This includes preventing drinking water usage in landscaping, creative solutions such as deployment of water rain and green roofs and wastewater.

Energy and Atmosphere: Use renewable energies in the location, for instance, geothermal pumps and solar cells panels in order to produce electricity and hot water.

Materials and Resources: Pay attention to recycle and reuse materials. Actually, use renewable materials, which are capable of using in nature chain again.

Quality of Environment in the Building: Consider having proper ventilation in the building and fresh air in classes, thermal control systems, sufficient light, acoustic control, and prevent any kinds of pollution to design green schools.

Innovation in Design: It is considered as credibility aspect of the building.

Region Priority: Region priority observance depends on different geographical territories and specific environmental characteristics. (Douglas 2010)

Green School in the World

One of the most remarkable issues in countries all around the world is to have green schools, even though they try to improve schools to be efficient and similar to green buildings. It is useful to study one of these schools as a sample to familiarize with them.

Portland Green School (ROSA PARKS ELEMENTARY SCHOOL PORTLAND)

This school achieved LEED Gold grade in 2007, which has been built in Portland – Colombia. Some of the characteristics of this green school are listed below:

Resistant native vegetation against drought, drinking water reduction, preserves trees that have been in the site during the construction, having light from skylights and using sensors to adjust the light, proper insulation, using photovoltaic system in order to generate electricity, using system ventilation for fresh air, and using materials that do not ruin environment.

Iran Green School

According to education organization's statistic data there are 30 green schools in Iran. To compare green schools in Iran with green schools in the world, it can be concluded that Iran green schools are far from criterions of green schools in the world and only a few of these standards are considered in each Iran green school, and this field requires more effort to achieve all green schools criterions. Therefore, green schools in Iran are not considered as an important issue. According to rapid population growth and the energy resources limitation, building green schools become an important issue. One of the criterions of green architecture is water usage efficiently. In the past providing water for caravansaries was so difficult because, there was no aqueduct near those places. Therefore, they provided water from rain. (Pirnia 1386). According to traditional architecture and using new technologies, it is possible to preserve the energy resources and environment and use energy resources efficiently. This is a crucial step to develop the country.

Conclusion and discussion

In architecture literature, educational area is considered as the second teacher. In recent years, education through educational area and environment become an important issue in international researches in educational landscape design. Despite, in Iran, school architecture conceptually and structurally are still as same as old schools such as Dar-al-fonun. According to the result of this research and green architecture criterions, schools in Iran cannot be considered as a modern school and educational aid device. In order to solve this problem, it is important to understand green architecture criterions and the effect of them on education. Therefore, sustainable or green architecture has become an important issue in all around the world.

There is no doubt that, one of the most important issue that human investigate it, in sustainable attitude particularly green schools (sustainable schools) is the attitude and method of energy resources usage, interaction resources, effect of resources usage. In design phase, these three characteristics should be considered that next generation profit from today, energy resources usage. According to fossil energies reduction and increasing trend of energy expenses, designers try to use renewable resources. They use new technologies in their design and change some building design elements to make it compatible with its region. Consequently, fossil energy usage would be reduced.

On the other hand, as the environmental issues become important in all around the world, one of the principle characteristic of developed counties in preserving environment and natural resources, policies to improve the education as the third dimension of sustainable development. Green schools are a program to teach student about environment and preserving environmental resources according to international standards. An environmental green school has several factors such as optimization of energy consumption; consider façade of the building and its cleanliness, different arts that can show environmental factors, green area and trees, increasing environmental knowledge beside teaching courses. In other countries, by regulation and culture improvement in society, green schools attitude, development, and applications are remarkably increased.

In the present time, Economization and optimization in the use of energy and utilization of constant energies, has the least role in our country's constructional culture. The traditional architecture values and the tradition of environmental values of Iranian traditional architecture, has a high value in the various methods of the optimum use of energy and the ecologic exploitation of energies (different kinds) and specially the application of constant and harmless energies. However, all the four philosophical and religious elements (i.e. air, water, soil and sun) have had the high environmental usage in the ancient Iranian civilization and architecture.

It all added up we can mention the very important point that we can, in the interior, construct the green buildings in accordance with our national culture by utilizing the Iranian traditional architecture and combining it with the modern global technologies, and contribute to economic growth and development of our country, by teaching people the optimum usage manners.

Practical Solution:

In order to develop and promote the green schools in the country as well as the optimum usage of this kind of schools, following practical solutions is recommended by the authors:

1- Holding the regional seminars in order to identify suitable areas for establishing the green schools and utilizing the clean energies in the country.

2- Holding seminars and conferences for the school donors and in order to explain the aims and the advantages of green school establishment as well as its long-term economic feasibility and economic return for the donors.

3- Encouraging researchers and Iranian scientific society for studying on weaknesses and strengths of the green school establishment in the country, and calculating the amounts of its economic feasibility compared to the ordinary schools.

4- Long-term planning and step measures in order to change the ordinary schools into the green ones.

5- The private sector and the non-profit schools could be mentioned as two of the best places and strengths for developing the green schools, because, through planning in this section, we can issue the certificate of the private schools establishment just for places that meet the requirements and potentialities of the green schools.

6- Planning to encourage the private sector for investigating in the green schools establishment.

7- Cooperating with agriculture universities, in the area prone to establish the botanical gardens in schools.

8- Utilizing the pharmaceutical plants in the structure of the schools for the economic exploitation of them.

9- Planting the ornamental plants within the school area and allocating some space for the establishment of a fair of these crops.

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