

# Intelligent school buildings can improve student performance by up to 30%

By Schneider Electric Buildings AB

What did you learn in school today? This classic question can soon generate significantly more inspired answers, thanks to modern building technology – with a little help from the financial crisis and the environment.

What our children learn in school and at universities is defined by a wide range of variables. Some are well known, such as personal motivation and abilities, the teaching methodologies of the teacher or school, and of course other educational resources – family, libraries, etc. Now, modern research points to another highly important factor in pupils' and students' intellectual development: the school's physical school environment, i.e. the education buildings as such.

The research results are quite astonishing, showing improvements in pupil performance of up to 30% and in some cases even more. The secret behind these results is the modernisation of education buildings through advanced building automation technology (integrated control and management of heating, ventilation, air conditioning and security), which creates intelligent buildings that provide an entirely new learning environment. This means that the entire educational sector stands on the verge of a giant leap forward.

The problem with many of today's schools is of course that they had their cornerstones laid in the late 19th or early 20th centuries, or they stem from the baby boom years that followed World War II. Most of them are not well adapted to the requirements of the modern educational system, and this has been the case for quite some time – due to the lack of funding. Now, however, it seems that times are changing on a large scale.

As part of the vast stimulus packages presented by governments worldwide to counter the recessionary effects of the financial crisis, and fuelled by today's heightened focus on environmental issues, funds are being made more readily available for initiatives and investments. "Schools of the future" in the UK and various programmes within the EU and US are promising examples of such political drives. With a rising political will to improve the educational environment and the increasing availability of funds, society can look forward to a giant leap in educational performance.

Bonus effects of the investments include substantial savings on energy and operating costs, as well as much lower carbon dioxide emissions from school buildings. In short, the new building automation technology influences all of the following issues:

- Health
- Energy savings
- Pedagogical results
- Security
- Environmental impact

## Health

Many education buildings are old and may exhibit environmental conditions that inhibit learning and pose increased risks to the health of children and staff. The three major risk factors for school building-related health complaints are inadequate ventilation, dust / inadequate cleaning and mould.

Poor indoor air quality is a known contributor to a number of significant health problems. In addition to increasing the rate of transmission for infectious diseases such as colds, influenza and tuberculosis, it has a role in asthma, which affects more than 5% – 10% of the school population. The management of indoor air quality through a modern integrated building management solution can significantly reduce the health hazards created by inadequate function in heating, ventilation and air conditioning. (For more information visit [www.automatedbuildings.com](http://www.automatedbuildings.com).)

## Energy savings

Many schools in use today were built in an era of inexpensive energy, when concern over energy costs was not among the central design criteria. Quite frankly, the potential energy savings in schools through new technology is enormous. Studies exhibit varying results depending on the site, but savings in the range of 15% – 30% are common. School districts can save 30% – 40% on utility costs each year for new schools and 20% – 30% for renovated schools.

As one example, Strandskolan elementary school in Malmö, Sweden reached an energy consumption low of 55 kWh per square metre

and year by installing an integrated building management system. The average for schools in the city is 120 kWh, and the difference translates into savings that can be redirected into Strandskolan's teaching resources.

## Pedagogical results

Not only does improved heating, ventilation, air conditioning and energy management in schools safeguard health and save on costs, research shows that an improved indoor environment also leads to a clear improvement in pedagogical results. A recent study published by the Technical University of Denmark shows a clear correlation between variations in airflow and temperature control and a student's academic performance. In experiments conducted both summer and winter at an elementary school in Denmark, pupils were given normal schoolwork in mathematics and language training (reading and comprehension). Clear improvements in pupil performance were registered, with top levels showing a 35% improvement and average levels a 15% improvement.

Other studies confirm these results. The University of Reading has measured work rate improvements of 7% in addition and subtraction with an improved indoor environment. In a Milwaukee research programme, Myhrvold et al reports a significant relationship between a facility's condition and student achievement in mathematics, science, language and social studies.

The clear relationship between student performance and an improved indoor environment is an important incentive for reviewing the current indoor environment in schools in order to support better learning. Learning, after all, is what school is all about.

## Security

Naturally, academic performance also depends on a student's ability to focus on his or her studies. When students feel comfortable and safe, it is easier for them to learn and perform. In a recent UK study, a large number of teachers responded to questions about security issues in their schools. Of these, 51% stated that the levels of indiscipline and crime in schools interfered with pupils' ability to learn. Another 33% said that it sometimes did.

Creating a peaceful environment in schools is of course a perpetual issue, and most of the answer lies in people and processes such as anti-bullying initiatives. But technology can lend a helping hand. Access-control and surveillance systems can both monitor and deter. And entrance systems can log a pupil's presence in the school, a feature appreciated by parents.

A study among teachers, students and parents in Sweden showed a high degree of acceptance for such solutions in schools. Of the students and parents surveyed, 70% or more would accept security solutions in schools (including CCTV) and over 80% said that such systems would decrease property damage, theft and violence.

## Environmental impact

Building energy often represents a large part of the overall energy consumption: values between 25% and 40% of all energy are calculated for the building sector within the OECD. And municipal buildings, with many schools among them, are thus a prime target for environmental efforts.

Creating a "green" school implies a wide range of activities, touching on everything from construction aspects to a well-managed recycling programme. Again, an intelligent building management system helps to achieve the environmental objectives through intelligent resource management such as dynamic control of lighting, heating and ventilation. The reduced energy consumption attained by such means can considerably diminish the environmental footprint of any educational institution.

## Conclusion

As we look to the future and the formative years of coming generations, a holistic approach to the educational environment must be taken – one that comprises teaching curricula and pedagogies but also the learning environment as such. By building the smarter schools of the future today, we can profit from short-term gains in cost and resource allocations while building a wholesome future for our children in the long term. A future that stimulates their knowledge and abilities, as well as one that safeguards their health and the environment of the world they live in.

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Indoor environment and learning in schools,  
DTU 2009

CEFPI 2000

Environmentally sustainable buildings,  
OECD2003

SSF 2009 (in Swedish)