

21st Century Learning Environments - a literature study-

**Sabbatical Report
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Whakarongo School**

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Introduction:

For many years educators gave very little attention to the development of learning environments. A clear indicator of this was the very basic brief that most architects received from schools. The brief normally focused on the purpose of the building, preferred position on the site and the available budget. Teachers were often engaged in debates that focused only on the colour scheme and the available storage.

With the development of new learning pedagogy, there has been a growing frustration amongst educators about the restraints many current learning environments place on them as they try to implement new teaching methods and class organization.

This report is a summary of some of the key aspects relating to school design for the 21st Century and focuses mostly on some reasons designs must change and some of the models that have been developed in an attempt to improve current practice.

Barriers to good design

One of the major barriers of the development of well-designed learning spaces is the lack of awareness amongst school leaders about the impact a well-designed space can have on learning. For many years the pedagogy used in large numbers of schools was a good fit for the “traditional” classroom and there has developed an acceptance that a learning space must look like a “traditional” classroom.

A second barrier is the lack of understanding of the coming changes in education and the radical different demands those changes will place on learning spaces and supporting areas.

A third barrier is that the examples and ideas of alternative approaches in design are relatively limited or not readily accessible. This is partly because there is a tendency to look for examples in other schools, rather than searching wider.

A fourth barrier is the reluctance amongst school leaders to try something new or do something different. Education is a relatively conservative field and school leaders often prefer to be reactive rather than proactive.

What is a Learning Environment?

For most people the term “learning environment” suggests a place and a space. Much of the 21st century learning takes place in a physical location, therefore most people immediately think of a school, classroom, workshop, etc.

In our ever-changing world that is increasingly technology driven and interconnected, a learning environment can also be virtual, online and remote. In other words, it doesn't have to be a “physical place” at all. In this way a learning space is more a support system that organize the conditions that we learn in – structures, tools and communities that inspire and support students and educators.

In this report I will focus on the more traditional model of place and space as it will be the dominant model for the foreseeable future, while incorporating the growing focus of learning that takes place in a context that promote interaction and a sense of community that enable formal and informal learning.

Major drivers of change in school building design:

Some of the external factors that will shape the design of schools in the near future include:

- Developments in Education: These include the development/change of learning and teaching styles, the need to use teaching staff better and the drive for higher levels of student achievement.
- Government policy: Areas of government policy, e.g. workplace reform and the link between education and social services, are some of the areas that will impact on school design.

- Social trends: With the increasing number of parents feeling pressured to work, and the rising number of single parents, more and more schools are taking on the responsibility for pre- and after-school care. Many children are also denied access to the outdoors – another area where schools are stepping in to fill the gap.
- Economic Imperatives: The move from a service-based to a knowledge-based economy has implications for the value of education to both the individual and the society. Businesses will need a flexible workforce with people who are inventive, cooperative workers and who are keen to learn.
- Classroom organization: Changes in the running of classrooms e.g. the use of group work or the range of class sizes all using the same space, all place different expectations on designs.
- Development in ICT: The continual growth in the use of technologies and the ongoing change in the nature of the technologies play an increasingly important role.
- Inclusion policy: The inclusion of students with special educational needs in mainstream schools demands some very specific facilities, e.g. wheelchair access, therapy and counseling spaces.
- Use of building: With the pressure on state budgets, the demand for better utilization of buildings will only increase. Community use of facilities will soon be seen as a given, rather than an exception.
- Need for flexibility and adaptability: This need is closely linked to a number of the other drivers but needs special mentioning, as it is also a very important part of the possible solution.
- Building technology: The development in building technology provides designers with new options and new opportunities to design smarter and more effective buildings. Hand in hand with this goes the demand for buildings to be more sustainable.
- Student demands: Students place a growing demand for buildings to be more student friendly, rather than just practical for teachers. This has the implication that school buildings need to make provision for social spaces, services, etc.
- Curriculum Changes: All over the world school curricula keep changing as a response to new demands. These curriculum changes also require school design to respond to meet the needs of the curricula.
- School organization: Longer days and changing timetables will also place additional demands on how spaces are designed and what facilities will be needed.

What do students want?

During many initiatives the input of staff and boards are often sought, but often students do not get the opportunity to be involved. A number of projects run by the Classrooms of the Future Programme (UK) asked groups of students about their ideas on the design of schools. Many ideas and designs resulted and some of these were:

Buildings must:

- be fresh, safe and new;
- delightful relaxing places to learn;
- not consists of squares or oblongs – no straight lines;
- have lots of natural light and fresh air;
- have lots of space and flexibility;
- use new technology;
- use new furniture – new ideas;
- have lots of green space;
- use solar and wind power;
- have different zones for different work, and
- have lots of colours, but not be too bright

A number of the pilot projects run by the Classrooms of the Future Project incorporated some of these ideas.

Current Trends that impact on Learning Spaces

The re-emergence of constructivist learning has led to the focus on learning, rather than teaching. This leads us to the re-evaluation of classrooms as learning spaces and to consider informal learning spaces as a vital part of the picture. If learning is not confined to classrooms, then the whole school (or all the spaces) is potentially a learning space.

The emphasis on learning means we must also think about the learner. Learning spaces is not mere containers for a few activities; they actually provide environments for people. Human factors such as eating and drinking, comfort, esthetics and flexibility now become increasingly important.

The Constructivist paradigm also places increasing importance on active learning, formative assessment, social engagement, mobility, multiple paths through content and a variety of outcomes.

Some of the key trends can be summarized as follows:

Trend 1: Facilities that encounter **learner participation** are increasingly important in the design of learning spaces. Active learning, interaction and social engagement will be more and more significant in the future.

Learning spaces have an important role to play in facilitating and encouraging this type of learning. Learners as active participants learn through interactivity, multiple roles (e.g. listener, mentor, presenter, critic) and social engagement (e.g. group work, wikis and chat).

Trend 2: **Human-Centered** design places and increasing emphasis on users and the range of services / needs they require. It then becomes a prerequisite that there is a clear understanding of what kinds of teaching and learning a space should enable and critically important is identifying the clients who will use the space.

These spaces will then be designed for specific people and support the creation and integration of information, have a social work setting, integrated support, comfortable and flexible furniture and meet human physical needs.

Trend 3: **Devices that Enrich learning** is a fundamental shift away from providing standard technology. With students bringing a growing number of their own devices (phones, MP3 players, laptops) to places of learning, the focus will shift from providing standard equipment, to providing a robust, contemporary technology infrastructure that provides high levels of access and interoperability.

Technology is important, as researchers have pointed to well-crafted use of technology benefiting learners in ways like:

- increasing performance gains;
- increased learner efficiency;
- greater student engagement and satisfaction, and
- more positive student attitudes to learning.

The implication for this change in provision is the additional expectations that users will have of learning environment – namely that learning spaces must facilitate the dissemination of content, recording of audio and video, sharing of work and storage, transfer of files, etc.

Design Principles

A number of groups/organizations have already developed sets of design principles they believe will guide the design of their buildings to be suitable for a 21st Century education. I believe it will be a worthwhile exercise to look at a number of these sets of principles.

Bendigo Educational Plan:

Background:

The Bendigo Educational Plan was developed to improve student outcomes in the Bendigo area with specific focus on reducing the number of students not completing their schooling. The plan identified specific outcomes for Students, Curriculum, Teachers, Community and Governance and School design. School design is thus not a separate entity, but an integral part of this plan covering all the major areas of education.

The vision was that the buildings should be welcoming and focus on the student as the learner. They should provide a variety of settings and with an array of ecologically sustainable design features e.g natural light, ventilation and the use of sustainable materials. The building should be living and learning buildings where users are aware of the relationship between the building and the environment.

Design principles:

- Design large, flexible spaces

These spaces should allow teams of teachers to work with up to 125 students in learning neighbourhoods using a variety of approaches and activities.

- Design space for multiple users concurrently and consecutively

Spaces designed for a single purpose limit the ability of a school to facilitate learning programmes based on individualized plans. These spaces should be both formal and informal and support teacher and student centered learning.

- Design to maximize the flexibility within each space

The inherent flexibility will ensure learners can undertake a range of activities as individuals and teams. ICT should also be everywhere and flexible furniture will enhance the usage and support flexibility.

- Design to make use of all dimensions

Design should ensure that the vertical dimension is also utilized to the full. This will enable student and learning materials to be displayed on the walls and from the ceiling.

- Design to integrate previously discrete functions

Functions like eating areas, formal and informal areas, outdoor areas and circulation areas must be used for sharing and learning at all times during the school day.

- Design to maximize teacher and student relationships

This can be achieved through the use of open staff rooms and visual connections between spaces. Spaces must be accessible to all and the number of locked areas should be minimized.

- Design to maximize student access to use and ownership of the learning environment

Giving students maximum access to the learning spaces will promote use and ownership of the facilities. The implication of this principle give students full access to ICT facilities, learning spaces and formal/informal furniture.

Building Futures Project

Background:

Building Futures was established in 2002 as a joint venture between CABE (Commission for Architecture and the Built Environment) and RIBA (Royal Institute for British Architects) to create the space for discussion about future building environments.

The project drew heavily on the 21st Century School material as commissioned by Ultralab. This material explored changes occurring in the education sector and used provocative scenarios to stimulate debate around key issues.

Design principles:

Designs of learning environment for the future should be:

- Flexibility: As learning models evolve, individual spaces should be flexible in use over the short-term as well as the long-term. Allowance should be made for variations in use, number of users and layout. Flexibility and specific use (as for a specific subject) should be carefully managed and infrastructure (e.g. ICT) should also accommodate flexibility.

In practice this might mean:

- keeping the width of spaces wide enough to allow a variety fo layouts
- avoiding awkward shapes
- limiting the number of fixed furniture and equipment

- Inspiring: Building should inspire those learning, working and visiting them. Spaces should embody the aims of the organization and should be inspirational, fostering creativity and a culture of learning. Wider learning (e.g. citizenship and sustainability) should also be supported.

In practice this might mean:

- Environmental issues can for example be expressed through location and the choice of materials.

- Supportive: Design should support effective teaching and learning. The design, from interior and detailed design to space configuration, should not constrain or inhibit learning. It should accommodate a wide range of experiences and activities, including all types of learning (intellectual, practical, etc). Management and technology should also be seamlessly integrated.

In practice this might mean:

- well places support spaces for small groups or staff;
- proper acoustics, and
- good lighting.

- Involving: The users, wider community and other educational and cultural organizations should be involved. The learning environment should belong to the community - teachers, students and community members should be involved in the design process. Better use of local resources should be made by creating and linking places of learning across the community. Physical design should where possible connect with their local urban context.

Nair and Fielding

Background:

Prakash Nair and Randall Fielding are two architects from the USA that are part of Designshare. They have written a book, The Language of School Design – design Patterns for 21st Century Schools. The book presents their attempt to put in writing their years of learning about schools and school facilities. This book is an “ideas book”, that builds on some timeless principles and lends itself to unlimited development and expansion.

Design principles:

In the book they have selected a number of patterns that represent a range of design principles that define best practice. Here is a summary of a number of them:

- Learning Studios: A learning studio refers to an L-shaped classroom that that can be configured in a number of different ways. This enables the space to function as a classroom and also accommodate a number of activity centers.

- Welcoming Entry: Entries are very important areas and should be inviting and friendly, not institution-looking and forbidding. It is important that this space contains some “signature” element that shows what makes the school special.

- Student Display Space: Having student work displayed sends powerful messages to visitors and students. Every opportunity should be utilized for decorating various parts of the school with student work. Displays can be in many forms, from the traditional paper work to digital displays to student-created gardens.

- Home Base: Irrespective of the model, students do need somewhere as a home base. Even older students seem to respond positively to this arrangement.

- Skill areas: Hands-on learning is important in any school. Areas for work in science labs, arts, home economics, technology etc. is therefore an important part of any school that aims to provide students with a range of opportunities.

- Performance: The growing awareness of how the brain works has highlighted the importance of integrating multiple-intelligences into learning experiences. It is now evident that the arts are part of the other disciplines and designs need to integrate provision for art, music and performance into other spaces.

- Casual Areas: With the concept of learning as you go and the use of spaces for a variety of activities, dedicated eating halls make no sense. Having a number of casual areas where students can eat and work is a much better concept.

- Interior and Exterior vistas: Students are required to learn for longer times. This extended time and the use of more technologies places huge strain on eyes. The creation of both interior and exterior vistas provide relief and brings the outside into the building.

- Dispersed Technology: The dispersal of technology is blurring the lines between learning spaces and support spaces. All parts of the school can now be learning spaces. With the right technology all rooms can be tech-intensive and even outdoor spaces can become places for peer tutoring, collaboration, etc.

- Indoor-Outdoor Connections: Being in the outdoors is part of our makeup as human beings. This connection is especially strong when we are young and every opportunity should be used to make the outdoors a natural extension of the indoor learning areas.

- Furniture: Furniture can play an important roll in providing flexibility in any space. The types of furniture can also encourage certain types of activities. With students spending extended hours at school, the provision of ergonomic and soft seating is also very important.

- Flexible Spaces: Flexibility needs to start in the classrooms – the primary learning area where most time is spent. Spaces need to be designed to accommodate as many learning modalities as possible.

- Variety of Space: In order to accommodate the variety of modalities, it is vital that a wide range of spaces should be catered for. These include campfire spaces, cave spaces, watering hole spaces, etc.

- Natural light and Ventilation: Daylight is important as there is a direct connection between our physical well being as humans and the amount of day light we get. Daylight is also important as it can substantially reduce the energy we use. Like daylight, natural air contributes to a healthy environment. It can reduce the amount of toxins in the air and prevent the formation of mold and its associated health problems.

- Connected to the Community: This connection can be created by making the school a welcoming place for the community and opening up the facilities. This has the benefit of bringing life to the school, providing additional resources and extending the learning potential.

JISC

The JISC consist out of are senior managers, academics and technology experts working in UK further and higher education. These experts determine JISC's programme of work to reflect the present and future needs of the education and research communities. One of the areas they have looked into is the design of school buildings. The increasing investment in property and technologies, combined with the need to be more cost effective, is making it more and more important for decision-makers to keep abreast of new thinking about the design of learning spaces.

Design principles:

A learning space is an expensive long-term resource and need to be able to motivate learners and promote learning as an activity. It needs to support collaborative and formal learning and provide a personalized and inclusive learning environment. It also needs to be flexible in the face of changing needs.

The design of the individual spaces needs to be:

- Flexible: Spaces needs to be flexible to accommodate both the current and evolving pedagogies. The best option is large open-plan spaces that can cater for both learning and teaching. This is a challenging concept for school leaders (sound, student activity, etc), but it is an essential element.

- Future-proofed: We cannot predict the future of pedagogical and technological development, but we can assure that designs will accommodate change. This means spaces will be able to be re-located and reconfigured in future.
- Bold: Designs need to look beyond the tried and tested technologies and pedagogies. They need to push the boundaries in order to get find solutions.
- Creative: Creative designs will energise and inspire students and teachers. They contribute to creating a positive environment.
- Supportive: Supportive spaces will help develop the potential of all learners.
- Enterprising: The spaces need to be capable of supporting different purposes.

In short

Most individual or groups involved in making decisions about learning spaces don't have a big interest in the theories etc. underpinning these principles and or trends. There are however 2 easy guides to assist groups coming to grips with the basics.

Ask these Questions:

- What kind of teaching would we like to see in these learning spaces?
- What kind of learning would we like to see in these learning spaces?
- Who will be using these learning spaces?
- What types of activities would we expect students to perform in these spaces?
- How can we make these spaces as flexible as possible?

Another easy way is to follow Prof. Stephen Hellepp's "Rule of Three":

One: never more than three walls

Two: no fewer than three points of focus

Three: always able to accommodate at least three teachers, three classes.

Education in the future

“Many of the schools that are being built are unsuited to the changing future pedagogy, curriculum and learning expectations that we can already anticipate. They also lack the agility to cope with the future anticipated changes that we cannot know in detail.”
(Steven Heppell – Ultralab)

While we keep current trends in mind when considering school design, it is also important to consider how education (or schooling) might look like in the future. Here we can consider education within our current framework of schools (reconfigure) as we know it, or alternatively at more radical changes (transformation) to schools.

The concept of personalized learning suggests the need to reconfigure educational systems to better reflect the needs of the learner and move away from the one-size-fits-all solution. Although the interpretation of the concept of personalized learning is open to debate, it will be fair to say that it implies a new view of the learner as an active partner in developing their learning pathways. This call to personalised learning suggests the need to create learning spaces that account for the different learning needs of learners.

When looking at the future of education we also have to look at the question whether we still will need school? The changing social role of education, increasing affordability of digital technologies, and the concept of life long learners, are all factors that make this question the more and more relevant.

To stimulate thought around this question, the EOOD, Ultralab and Design Council has developed four scenarios outlining some more radical options for “school”. Although none of these scenarios will happen over night, it is important to keep them in mind when considering school design as school buildings are normally in use for many decades after their construction.

The first scenario involves a Network of Learners - no physical school at all. Students are based at home, learning online and getting help for all over the world. This will obviously make any major investment in learning spaces unnecessary and money would be directed towards student support and tutors monitoring learners.

The second scenario is the Dissolved/Dispersed School, where buildings and functions might be spread across the town (a bit like an university). This model will still require learning spaces, but these will be shared with the whole community and serve learners of all ages as life long learners.

The third scenario is to Extend School into an all-embracing community of its own. Life will be spent on the campus without following a traditional timetable. This offers almost infinite flexibility with learning taking place whenever and wherever.

The final scenario is the “Fortress” School. In this school learners are protected from society behind high walls and learners are focusing at all times on the formal learning. They only leave the “fortress” once they are ready to be re-introduces to the dangers of society.

None of these scenarios are necessarily right, but they do offer conceptual tools for exploring how to reinvent schooling that meets the needs of learners and learning communities in the 21st Century.

Conclusions

From what I have read and seen, I have come to the conclusion that there are a number of issues that get mention in the majority of texts. These issues are, in my mind, key to any 21st Century design. The key issues I have identified are:

Flexibility: All new spaces must be designed with the highest degree of flexibility – flexibility in daily use as well as flexibility for possible future changes.

Group sizes: It might take a while, but schools will reorganize themselves with bigger groupings of students (around 120) supported by a team of teachers. Spaces need to be designed in such a way that there is a big enough central space to handle a bigger group.

Technology: Technology is already playing a big part in many schools today. The increase in the availability and the changing nature of technologies is a factor that needs to be catered for. It is also a factor that can contribute to the solution as it can help create flexibility.

Student involvement: Students’ needs will become a bigger factor in the design of schools in future. For this reason, students will need to be given the opportunity to have a bigger input in the design of schools and the learning spaces.

Nature of School: The nature of many schools will most probably change dramatically in future. We will have to consider how buildings constructed in the near future will be able to cater as support systems for future learning.

There is a huge responsibility on the shoulders of school leaders to design and construct school buildings that will be able to support and further learning in the 21st Century. This is a scary thought, but on the other hand also a very exciting challenge.

Some practical examples

In a number of schools all over the world, school and communities have been brave enough to venture into the unknown and started including some of the characteristics / principles / features as described above. Some of these schools are:

Crusoe College (Kangaroo Flat, Bendigo)

Crusoe College is one of the four new Junior secondary schools that was constructed as part of the Bendigo Educational project. A different architect designed each school, but the design had to adhere to a basic concept as agreed by the Project Group. The Crusoe College design is clearly an effort to maximize the benefits of the basic concept.

The school was built in learning communities with 1 specialized room (gym, music, technology, etc) attached to the big central space of each learning community. The central space is big enough to house a group of students that would normally fit into 4 classrooms. Each community also has 1 withdrawal space that can be used for formal teaching as well as office and work room spaces. Nearly all these spaces are open plan or are separated using glass. The bigger space has been fitted with a variety of furniture – including desks, chairs and soft furniture. Low-level lockers have been used to separate different areas without forming a visual barrier. This design facilitates the formation of a learning community, independent learning, peer tutoring, small group work, project based learning and seminar style learning.

Silverton Primary School (Noble Park, Melbourne)

Silverton Primary has a relatively old school building but it has been adapted in such a way that it can be seen as an example for new designs. The school has no single cell classrooms at all. Students are organised in groups of 100-120 students of the same age group and supported by 5 teachers.

Each group works in a big open space with a number of smaller adjacent spaces. All the adjacent spaces have been set up to support a specific need and is separated with glass partitions. During class time the bigger group is split up into smaller groups which work in a dedicated area in the bigger space or make use of one of the more specialized spaces. This arrangement ensures that students get matched with the “best” teacher and also provides the opportunity for the use of equipment to be maximized in each space.

Marner Primary School (Bow, London)

The new building for Marner Primary is currently being constructed in London's East End and in many ways looks like a traditional design. The school does however have some very interesting features.

The school's learning environment is fully ventilated by solar powered ventilation solutions. Rainwater is stored in tanks below ground level and connected back through the toilets. Green roofs have been designed to attract wildlife and birds to this inner city school and webcams have been installed for student access. All the services and sustainable elements have been connected to a comprehensive building monitoring system. Data from this system is displayed on screens recessed in the corridor walls.

Most importantly though is that the building is designed with large open floors with no supporting structures in the middle. Internal lightweight partitions and bi-folding walls ensure the spaces remain flexible and adaptable for many years. This is a great example on how to future proof the building so that the design can easily be changed to accommodate changes in curriculum a requirements.

Hampden Gurney Church of England Primary School (Marble Arch, London)

This school is situated in inner London on a very small site. They have constructed a round multi story building with curved play decks on each floor. The decks have a glass balustrade and glass doors separating it from the adjacent classrooms and library.

This interesting design allows for:

- more "outdoor" space for playing;
- external vistas;
- provides a sense of space;
- provides outdoor areas that become an extension of classrooms;
- brings the city into the school while still providing a secure setting for students, and
- provides plenty of natural light and air.

Meadlands Primary (Richmond, London)

Meadlands Primary has a classroom that was funded by the Classroom of the Future project. It has a futuristic dome shape and is built off site as a modular unit. Some of the features are the coves with whiteboards covering the sides and small round tables with stools that go with each cove.

This design had the following impact:

- very flexible as there are no set layout;
- encourages independent work;
- space on walls show progression of work, and
- big door at front and "extend" the room onto the deck.

Vensterschool Oosterpark (Groningen)

Oosterpark is one of the Vensterschools in Groningen. The basic design of these schools are very traditional, but they are quite different in terms of their composition. What makes the unique is the fact that the schools and a number of services and community groups/activities have been integrated into a single building or campus. This brought the community and school together and provides the opportunity for students to have access to a number of services (medical, social etc.) and for the community to make use of the library, sports facilities etc. A number of community groups have also become involved in supporting the schools in a number of ways.

Key Resources:

Bendigo Educational Project

CABE (Commission for Architecture and the Built Environment)

Sorrell Foundation

Futurelabs

Nair, Prakesh and Fielding, Randall: The Language of School Design (Designshare)

21st Century Schools – Learning environments of the Future (Building Futures)

Trends in Learning Space Design – Malcolm Brown and Philip Long

21st Century Learning Environment – Partnership for 21st Century Skills

Designing Spaces for Effective Learning – guide to 21st century learning space design (JISC)

What if Re-imagining learning spaces – (Futurelab, UK)

Classrooms of the Future (Department of Education and Skills, UK)

The impact of digital technology (Becta, UK)

Being involved in school Design (CABE, UK)

Reimagining outdoor learning spaces (Futurelab, UK)

Furniture for Schools – Anna Holder (Bureau Design + Research)

Transforming Schools for the Future? (Futurelab, UK)

Seriously Cool Places: The Future of Learning-Centered Built Environments – W. Dittoe

Picturing school design (CABE, UK)

Our School building matters (CABE, UK)

Joinedupdesign for Myplace (Sorrell Foundation)

Manifesto for Learning Environments (British Education Suppliers Association, UK)

360 deg. – learning through building and spaces (CABE, UK)