iN**2015**< IMAGINE YOUR WORLD

EMPOWERING LEARNERS
AND ENGAGING MINDS,
THROUGH INFOCOMM

Report by the iN2015 Education
and Learning Sub-Committee

**Singapore: An Intelligent Nation, a Global City,
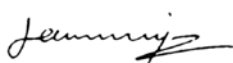powered by Infocomm**

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Preface

Education is about preparing our people for the future. To thrive in the world in 2015, Singaporeans need strong analytical, communication and interpersonal skills. They have to be more risk-taking, entrepreneurial and able to tolerate greater ambiguity. Most importantly, they need to continuously learn, unlearn and relearn to remain relevant in a dynamic environment.

The education experience must be an engaging one that stimulates the learners, challenges them with authentic learning experiences, encourages them to work in a team, and motivates them to seek, integrate and create knowledge. More importantly, the love for learning must extend to all aspects of life and through life.

The skills and competencies of the teacher will always be essential to engaged learning. Education and learning will continue to revolve around learners, teachers, libraries and educational institutions.

But infocomm will help bring about new and exciting possibilities for inspiring teachers and their motivated learners. Beyond reading printed textbooks, learners can learn through games or find out about the latest scientific discoveries online. Beyond consulting teachers face to face, learners can learn from peers and consult experts located thousands of miles away. Beyond the confines of the classroom, learners can learn where their interests take them, from museum to park or café. Beyond paper and pencil tests, teachers can monitor progress of learners through online quizzes and other new assessment modes. Beyond one instruction approach for all, teachers can customise learning materials and tests for learners of different interests and abilities. Beyond learning in schools, learners can form virtual online communities and share with like-minded individuals. Adult learning can adopt a fully online mode, or a blended model of online and face-to-face instruction. Resources of the libraries can be made available to the individual through a device of his choice.

Singapore is well-positioned to harness infocomm to transform education and learning. In this report, we have chosen to focus on the public education system, which educates the vast majority of our young and helps them acquire life-long habits of independent learning and infocomm usage. The public educational institutions provide the critical mass to catalyse developments across the entire sector. Our plan also leverages on MOE's on-going efforts in its Masterplan for IT in Education II or mp2. Learning for work and leisure, using resources from our libraries and beyond, will be a way of life.

We want to create a virtuous cycle, of innovative usage driving innovations by our infocomm companies and research institutions. Successful deployments in Singapore in turn spur exports, build strong infocomm companies and grow our national capacity to innovate further, thus driving users to think of even more creative ways to harness the new technologies.

The needs of the education and learning sector will also create a clear demand for a new national broadband infocomm infrastructure and provide exciting new jobs in the infocomm industry.

The transformation of the Education and Learning sector through infocomm is an ongoing journey that requires the partnership of the public, private and people sectors. While the iN2015 Education and Learning report focuses on the public education sector, many of the lessons and applications are applicable in the areas of private education and adult learning. This report is meant as a guide and as a basis for the continued dialogue between the education community and our industry partners who share the same vision and passion as us – *"Empowering Learners and Engaging Minds, through Infocomm"*.

Mrs Tan Ching Yee
Chairman
iN2015 Education and Learning Sub-Committee

iN2015 Education and Learning Sub-Committee

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Executive Summary

Powerful trends in globalisation, technology and economic liberalisation are accelerating the pace of competition across the world. Human capital is Singapore's key competitive differentiator in the evolving economic landscape. It is essential that our people have the attitudes and skills to learn, re-learn and unlearn, in order to thrive in the face of an unpredictable future.

Infocomm is a key enabler that can help us enrich the learning for the individual and to expand our nation's capacity.

It does so by enabling access to the latest knowledge and new learning resources, making learning come to life with multimedia and interactive elements, facilitating collaboration within and across learning communities, supporting educators' efforts in customising teaching for different learners, and creating an environment in which independent and life-long learning takes place.

Learners in 2015 will access the latest learning resources using personalised learning devices. Content will be delivered via ultra high speed broadband networks. Learners can choose to learn anytime and at any place, leveraging on pervasive wireless access. Learners collaborate with one another over the network, using collaborative tools. Educators guide learners, by customising learning plans and resources, and using new assessment tools to monitor their progress. The habits of independent search, integration and construction of knowledge and the skills acquired from working together with others will equip our people to continue to adapt and learn. Even after they complete formal education, they will continue to access resources in the community, including the public libraries, for work and leisure.

To realise the vision of learning in 2015, the Education and Learning Sub-Committee has developed the following goal and outcomes.

Goal	To foster an engaging learning experience to meet the diverse needs of learners in Singapore, through the innovative use of infocomm		
Outcomes	Our people experience engaged learning and enriched lives, and Singapore benefits from enhanced national capacity	Our educational institutions, with their pervasive and innovative use of infocomm, are magnets for global talent	Our infocomm industry is recognised for its innovative Education and Learning products and services

The strategic thrusts together with areas of focus which would yield the largest impact have been further identified.

Strategic Thrust 1	Strategic Thrust 2	Strategic Thrust 3
Creating an enriching and personalised learner-centric environment in our educational institutions	Building a nation-wide Education and Learning infrastructure	Positioning Singapore as a centre for innovation in the use of infocomm technologies for the Education and Learning sector
• Use infocomm to support changes in pedagogies in our educational institutions • Develop new learning resources and new infocomm-enabled assessment modes • Build capabilities of teachers, school leaders and curriculum planners • Develop incubator educational institutions that will generate innovation in the use of infocomm to support engaged learning	• Make broadband infrastructure affordable and accessible to educational institutions • Build a network of knowledge assets for lifelong learning	• Forge strategic partnerships with key companies and research institutions in this field, and locate test-bedding, prototyping and R&D centres in Singapore • Develop a R&D agenda on new technologies and models for harnessing infocomm in E&L • Develop capability in industry to harness infocomm for E&L

In drawing up a roadmap to achieve the outcomes, the Sub-Committee recognises the need to prioritise and focus our efforts where transformation will have the most impact. It is proposed to start with our public schools and tertiary institutions. They educate the vast majority of our young, and help them acquire life-long habits of independent learning and infocomm usage. At the same time, the public educational institutions also provide the critical mass and market size to catalyse developments across the entire sector.

Through these efforts, demand for infocomm products and services will be created, spurring innovation by infocomm companies and research institutions, and shaping their R&D agenda. Efforts in catalysing the use of infocomm in Education and Learning will be supported by developments in the national infocomm infrastructure and manpower. IDA can also work with industry players to build capabilities amongst infocomm local enterprises (iLEs) to capture the economic spin-offs from our investments in infocomm.

The **EdVantage** programme is our proposed roadmap. It aims to strategically deploy infocomm in education to provide a learner-centric, collaborative environment that extends beyond the classrooms, thereby enabling a diverse and vibrant schools landscape in the use of infocomm. The programme adopts an approach of building a strong and broad base of infocomm usage in our public educational institutions, and encouraging peaks of excellence to emerge.

EdVantage comprises three components: iACCESS, iLEARN and iEXPERIENCE.

iACCESS provides the infrastructure, **iLEARN** makes available interactive digital learning resources, while **iEXPERIENCE** integrates these through the development of applications for learners to enjoy a wonderful learning experience. To make all these components work together, we need visionary school leaders and dedicated teachers, and many partners in the infocomm industry, like instructional designers, application and game developers, digital content providers and infrastructure operators.

On this broad and strong base, all our schools will be competent users of infocomm. Among them, 15-20 per cent *(Experimental Schools)* will be test-beds for the innovative use of infocomm in teaching and learning. Another five per cent will be exemplary in their integration of infocomm into learning, while experimenting with emergent technologies that will become more widely used in the future. These *Schools of the Future* will serve as beacons of innovative infocomm usage in the education setting, for Singapore and beyond. Through this, Singapore's reputation as an education and infocomm hub is further enhanced. Our infocomm enterprises are also well-positioned to export their products.
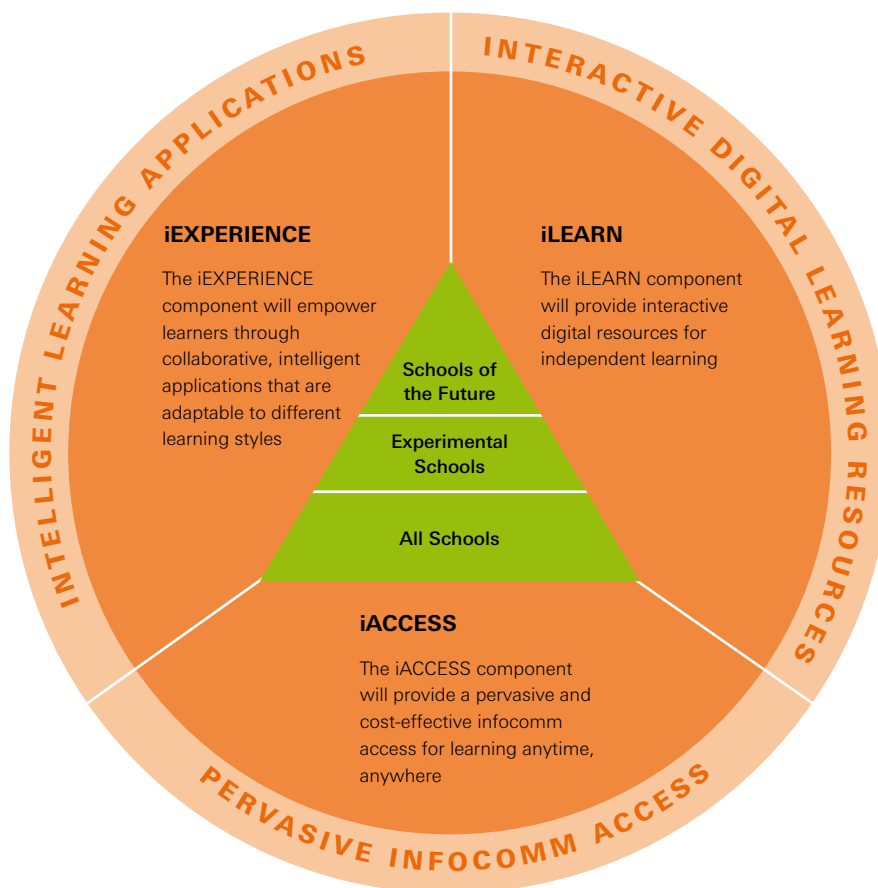

Figure 1: EdVantage Programme

CHAPTER 1
OVERVIEW OF EDUCATION AND LEARNING SECTOR

Singapore's Education and Learning Sector

The Education and Learning sector comprises a wide variety of providers of education and learning services, ranging from formal educational institutions like the schools, institutes of technical education, polytechnics, tertiary arts institutions and universities under the purview of the Ministry of Education, to the public libraries, private schools and organisations offering enrichment and personal improvement programmes. There are also related activities like publishing, gaming and online learning.

The iN2015 Education and Learning report will focus on formal education as this sector covers the majority of our young learners who are still in their formative years. This is also where we can ignite their passion for learning in their early years.

Current Landscape

Public Educational Institutions[1]
At the core of academic education is the public education system. There are approximately 26,400 teachers and 532,000 students in 355 primary and secondary schools, junior colleges and centralised institutes. Another 130,000 learners attend full-time programmes in 12 post-secondary educational institutes, which include our institutes of technical education, the tertiary arts institutes, polytechnics, National Institute of Education and the three Government-funded universities – the National University of Singapore (NUS), Nanyang Technological University (NTU) and Singapore Management University (SMU).

Singapore has always placed Education as a key priority in our nation building, as reflected in the investment in education. For the year 2004/2005, the public expenditure on Education was 3.5 per cent of Gross Domestic Product (GDP), or about S$6 billion. This compares with the average expenditure of 5.4 per cent of GDP spent by developed countries in the Organisation for Economic Co-Operation and Development (OECD)[2]. Over the years, Singapore has invested well and built a strong education system, which is a source of national competitiveness.

Our learners have high aspirations and are recognised internationally for their high levels of achievement. Our universities are also internationally recognised and have consistently ranked amongst the world's top 50 universities.

Private Education Service Providers
Singapore has also developed a diverse private education sector. Based on the latest statistics from the Department of Statistics, the education services industry comprised approximately 2,800 establishments, employing a total of 49,300 workers and contributed to about three per cent of GDP[3]. The Singapore Economic Development Board (SEDB) has attracted world class tertiary and specialised educational institutions, such as the University of New South Wales, University of Chicago's School of Graduate Business and the DigiPen Institute of Technology, to set up in Singapore. At the end of 2005, there were more than 70,000 international students in Singapore[4]. Total business spending and value-added by the private education industry was S$111 million in 2005 and S$103 million respectively[5].

Strong and Robust Education System is Singapore's Key Competitive Strength

"We have a strong and robust education system that has been a key source of competitive strength for Singapore. It is a key differentiator, something that still gives us an edge today over many other cities."

Tharman Shanmugaratnam, Minister for Education in MOE's Work Plan Seminar 2004

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1   Data from Ministry of Education
2   Education At A Glance Report, OECD indicators, 2005
3   Economic Surveys Series for Education Services, Singapore Department of Statistics (DOS), 2005
4   Singapore Economic Development Board, http://www.edb.gov.sg/edb/sg/en_uk/index/industry_sectors/education_services.html
5   Economic Surveys Series for Education Services, Singapore Department of Statistics (DOS), 2005

Education service providers have also implemented online learning models, either as part of a blended model, like Informatics' University of Portsmouth Bachelor of Science in Computing programme which complements e-learning with face-to-face interactions, or in full like U21Global's online Masters of Business Administration[6].

Public Libraries

Libraries play an important role in complementing Education and Learning, with their vast resource databases and conducive learning spaces. The network of more than 40 public libraries in Singapore serves over 1.8 million library members and about 30 million library visitors a year. The public is able to tap on the libraries' vast and diverse collection of more than 8 million print, non-print and digital resources[7].

International Accolades of Singapore's Education System

International Association for the Evaluation of Educational Achievement (IEA)'s Trends in International Mathematics and Science Study

1st in the world for 4th[*] Grade Level Maths & Science Benchmarks

1st in the world for 8th[**] Grade Level Maths & Science Benchmarks

Source: IEA's TIMSS 2003 International Report on Achievement in the Mathematics Cognitive Domain.

World University Rankings

Top 50 Universities in Technology

National University of Singapore (9th ranking)

Nanyang Technology University (26th ranking)

Top 50 Universities in Social Science

National University of Singapore (13th ranking)

Source: The TIMES Higher Education Supplement, 2005

* Equivalent to Primary 4 in Singapore's education system
** Equivalent to Secondary 2 in Singapore's education system

Wide Usage of Infocomm in the Education and Learning Sector

Singapore has long recognised the importance of harnessing infocomm technologies. Our past efforts have resulted in a high level of infocomm-sophistication among our people. We have one of the world's highest Internet and mobile penetration and computer ownership. Nearly all Internet users used the Internet for communication (96 per cent) and getting information (89 per cent)[8]. Singapore has also been consistently ranked amongst the top three countries in the world by the World Economic Forum in our readiness to harness infocomm for economic development[9].

This emphasis was also reflected in the Singapore IT Spending and Industry Segmentation Report June 2005 by the International Data Corporation (IDC) which states that the total estimated infocomm spending in Singapore for this sector in year 2004 was US$231.5 million. This accounted for approximately eight per cent of Singapore's total IT spending by user sector.

6   U21Global, http://www.universitas21.bham.ac.uk/u21global.htm#About
7   National Library Board of Singapore, http://www.nlb.gov.sg/CPMS.portal?_nfpb=true&_pageLabel=CPMS_page_All
8   Annual Survey of Infocomm Usage in Households and by Individuals 2005, IDA Singapore
9   WEF Global Information Technology Report. Singapore was ranked 2nd, 1st and 2nd in the 2003-2004, 2004-2005 and 2005-2006 reports respectively

This high level of maturity was made possible in part through past Government efforts in the Education and Learning sector. A broad overview of these plans is outlined below.

Ministry of Education's (MOE) IT Masterplans (1997 – current)

The first masterplan for IT in education, launched in 1997, had established a strong foundation for the use of infocomm in teaching and learning. It put in place an excellent IT infrastructure, built up the competencies of teachers and learners in the use of IT and initiated a mindset change in the way IT was used in the schools' instructional programmes.

Building on this foundation, MOE's IT in Education Masterplan II (mp2), which was launched in 2002, aimed to deepen this transformation. The masterplan envisions that IT is pervasively and effectively used to enhance educational processes and structures to bring about engaged learning for pupils and enabling the 'ability-driven' paradigm. Schools are empowered to experiment, optimise, contextualise and integrate the use of IT in deeper levels.

Aligned with mp2's objectives, the National Institute of Education (NIE), together with MOE, set up the Learning Sciences Laboratory (LSL) to study the use of emerging technologies in learning and its integration with pedagogy. Launched in 2004, LSL targets to inform and design classroom practices through Learning Sciences research that looks at transforming processes and pedagogies through technology, as well as provide systemic reform recommendations that will eventually lead to scalability and sustainability for schools.

Institutes of Higher Learning (IHLs) Infocomm Technologies Plan

While the scope of MOE's plans focused largely on the primary and secondary schools and the junior colleges, IHLs in Singapore have also embarked on their own infocomm plans and have built strong foundations with the pervasive infocomm adoption amongst both the student population and teaching staff. For example, the IHLs have built wireless networks on their campuses to provide learners with seamless connectivity beyond the lecture rooms, and encouraged laptop ownership.

Besides providing an excellent infocomm infrastructure, the IHLs have used infocomm extensively in school administration, and for teaching and learning. Administrative applications such as course registration and online library services are provided to enhance the convenience to learners. Teaching and learning applications such as e-learning systems, interactive simulation games and collaborative work tools are also used to enhance the learning experience and to complement existing classroom teaching. A good example is NUS's Integrated Virtual Learning Environment (IVLE) which provides each course with its own workspace for instructors and learners. The workspace includes a knowledge repository for learning resources such as lecture notes, lesson cases and simulation models, as well as virtual communities and functionalities for class administration.

National Library Board's (NLB) Library 2010 (L2010)

The public libraries in Singapore are pioneers in the use of infocomm to deliver personalised library services, such as enabling the 24-hour return services at all branches, regardless of which library the book was borrowed from, and the launch of the one-stop integrated digital library which allow users to search for library resources and even receive book recommendations based on personalised book preferences.

The L2010 is NLB's second masterplan. Its vision is to bring the world's knowledge to Singapore to create positive social and economic impact. As part of L2010, NLB will be expanding its Digital Library initiative to increase its digital resources and build a network of knowledge assets, aiming to be the preferred stop for Asian content and collection services.

Partnership with the Infocomm Industry

The success of these plans owes much to the strong partnership between the Education and Learning sector and the infocomm industry. MOE and its educational institutions have collaborated with partners like Microsoft and HP in capacity building and the test-bedding of new technologies.

CHAPTER 2
TRENDS AND IMPLICATIONS

Trends in Education and Learning Sector

The following trends that would impact the Education and Learning sector were identified.

Political/Government

- The Education system is evolving towards focusing on quality rather than quantity. Learners are given more opportunities to discover their talents along more diverse pathways to meet changing needs. For example, in Singapore, specialised schools for sports and arts education were set up to cater to different interests and nurture a wider spectrum of talents; and

- There is a greater emphasis on developing a spirit of creativity and innovation in the young, through engaging interactions between the teachers and learners. Syllabus will be reduced to provide learners with more space to explore and discover their talents. At the same time, teachers have greater time to think, reflect and find ways to bring out the best in their learners.

Economic

- Technology, advanced communications and greater economic liberalisation have resulted in a highly competitive global economic landscape. The next generation worker will require new competencies, including making sound complex business decisions, working productively in teams and interacting effectively with customers;

- Education and Learning has become a significant economic activity, with a strong export component as opposed to heavier past emphasis on domestic consumption; and

- Increasingly, the Education and Learning sector is linked to a larger cluster of economic activities, such as publishing and online learning. There is a new global trend towards more cross-border online education services. At the tertiary and post-tertiary levels, learning leverages on the Internet to provide greater interactivity and enable collaborative learning.

Social

- There are emerging groups of new learners in the economy, which include workers requiring re-skilling, women returning to the workforce, retirees learning for enjoyment. Learning communities based on common interests rather than geography are also being formed;

- Learners are also exposed to infocomm at a young age. New generation of learners are comfortable with multi-sensory and multi-threaded forms of interactions.

Technology

- Processing power and memory, and the corresponding decrease in prices will continue to outpace human capacity to exploit them;

- Advances in the area of immersive technology, connectivity and social software will catalyse fundamental shifts in learning;

- Advances in neuroscience and cognitive science research findings have provided deeper insights into the learning process, teaching and learning environment, socio-cultural processes and other factors that contribute to effective and engaged learning. Teaching and learning need to change to reflect how people learn.

Role of Infocomm

To prepare for life and work in the 21st century, we need to foster the goals of a 21st century learning disposition. We need to create an authentic learning[10] environment, which motivates and brings about engaged learning[11].

While the fundamentals of the education system will remain largely unchanged, centred upon the social interactions between teachers and learners and among learners, we do envisage a shift towards a more open and globalised setting where communities of learners are formed based on common interests. Learning will change along several dimensions.

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10 In this learning environment, material and activities are framed around "real-life" contexts, therefore allowing learners to connect with the "real-world". This approach allows the material to be made meaningful for the learners. Learners will be more motivated and learning will be better internalised.
11 Learners take greater responsibility for their learning, defining their learning goals and evaluating their achievements. This entails a less prescriptive approach to learning and allows greater customisation for each learner, with the teacher playing a more active role as a mentor and coach.

TODAY	2015
Teacher-centric	Learner-centric
Learning in the classroom	Learning beyond the classroom
Didactic learning	Collaborative and investigative learning
Reliance on textbooks	Reliance on "real life" or virtual experience
Local learning resources and expertise	Global learning resources and expertise

Infocomm will be a critical part of Singapore's response to these trends. It will transform the learning experience, in the following ways:

- **Connectivity** – Learners will be able to access learning resources through a cost-effective and high-speed infocomm infrastructure to allow learning to take place in schools, at home and on the move via their personalised learning devices. This enables a seamless learning experience for our learners;

- **Content** – Teachers and learners will be able to access digital content that is relevant and current. The learning experience of learners will be stimulating and engaging, with greater interactivity via digital resources. Innovative pedagogical strategies, such as using games for learning can be widely deployed;

- **Collaboration** – Infocomm will enhance collaboration and interaction amongst peers and between teachers and learners. This collaboration will expand beyond the classroom, and into informal social networks. Educational institutions will also rely on infocomm to reach out to the larger community, creating dynamic communities of practices for learning for both learners and teachers;

- **Capacity** – Learners, in the process of using infocomm technologies to multi-task, create, analyse and transform information and to interact effectively with others, will acquire higher-order thinking and analytical skills; and

- **Culture** – Infocomm will help to catalyse changes in the learning culture in educational institutions by supporting new approaches in teaching and learning and enhancing their attractiveness as an education destination for international learners, allowing greater personalisation to cater to different learning styles and aptitudes.

These trends and drivers will shape the future Education and Learning landscape, not only in Singapore but also the rest of the world. Economies that are best able to transform their education systems to leverage on these changes will be able to reap significant future national benefits; those who do not risk being left behind.

Overseas Developments

Other countries too have recognised that integrating infocomm in Education and Learning is essential for national competitiveness, and have in recent years launched similar programmes aiming to become the world leaders in infocomm adoption for Education.

One example is the United Kingdom (U.K.) government, which launched the 'Building Schools for the Future' programme that provided funding[12] for all secondary schools to be equipped with advanced infocomm facilities within 10 to 15 years, starting from 2005.

In the United States (U.S.), various states like Michigan, Texas and Florida have embarked on key programmes to leverage on infocomm in Education and Learning. One key example is Maine's one-to-one laptop programme, which spent about US$37 million from 2002 to equip 34,000 secondary-level learners and 3000 teachers with iBooks operating in infrastructural-ready wireless school environment. The participants felt better prepared with skills relevant for their future and were also more motivated in their studies.

In January 2005, the MIT Media Labs announced the development of the US$100 laptop device and the One Laptop Per Child initiative. These laptops are sold and distributed through the Ministries of Education of the participating countries like India, China, Thailand and Brazil. It is expected that every child in these countries will be equipped with low-cost laptops as an educational tool to access Internet-based content starting from 2007.

Governments have also recognised the importance of digital curriculum content as the powerful mechanism to support consistency in national curriculum and to aid in teacher performance. U.K. has an online portal (Curriculum Online) that provides schools with educational digital resources from public and private sectors. The Learning Federation (TLF),

an entity funded[13] by the Australian and New Zealand governments, creates learning objects. The global trend of outsourcing is also observed in Hong Kong, where the Hong Kong Education City Limited finds, edits and disseminates digital educational resources nation-wide.

Some economies also tap on existing public resources from libraries and museums. Finland and the Canadian state of Alberta collaborate with libraries (physical and electronic, public, school-based, and specialised) to promote universal, barrier-free access to content for schools. The TLF, in Australia and New Zealand, also works closely with the national libraries and museums to build up the digital resources.

In general, the management, access and sharing of digital content are common soft infrastructure issues to be addressed. As an example, the Alberta government ensures system-wide access to existing digital resources through a single portal (LearnAlberta.ca), and has also initiated an online community for sharing of resources and expertise. Where hard infrastructure is concerned to support digital content access, governments like Alberta, Hong Kong and U.K. have also implemented high-speed bandwidth in tandem with their national vision to support schools' use of infocomm for Education and Learning.

Singapore's Response: Maintain and Entrench Leadership

Although Singapore has done well in the past, other countries are also investing aggressively and catching up. It is therefore critical that we do not rest on our laurels but continue to innovatively harness infocomm technologies for Education and Learning to enhance our national capacity and competitiveness. Our plans to maintain and entrench Singapore's leadership position are outlined in the next few chapters.

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12   Current reports indicated that £2.2 billion was set aside for 2005-06
13   Reports indicated A$34.1 million as seed funding

CHAPTER 3
IMAGINE: EDUCATION AND LEARNING LANDSCAPE IN 2015

In 2015, we will still have learners, teachers, schools, libraries and books. But they will learn and teach in different ways, interact in more diverse and interactive ways, forge partnerships and collaborations across borders, and create new models of pedagogy.

The scenario below seeks to illustrate how teaching and learning can take place in 2015.

iN2015 Education and Learning:
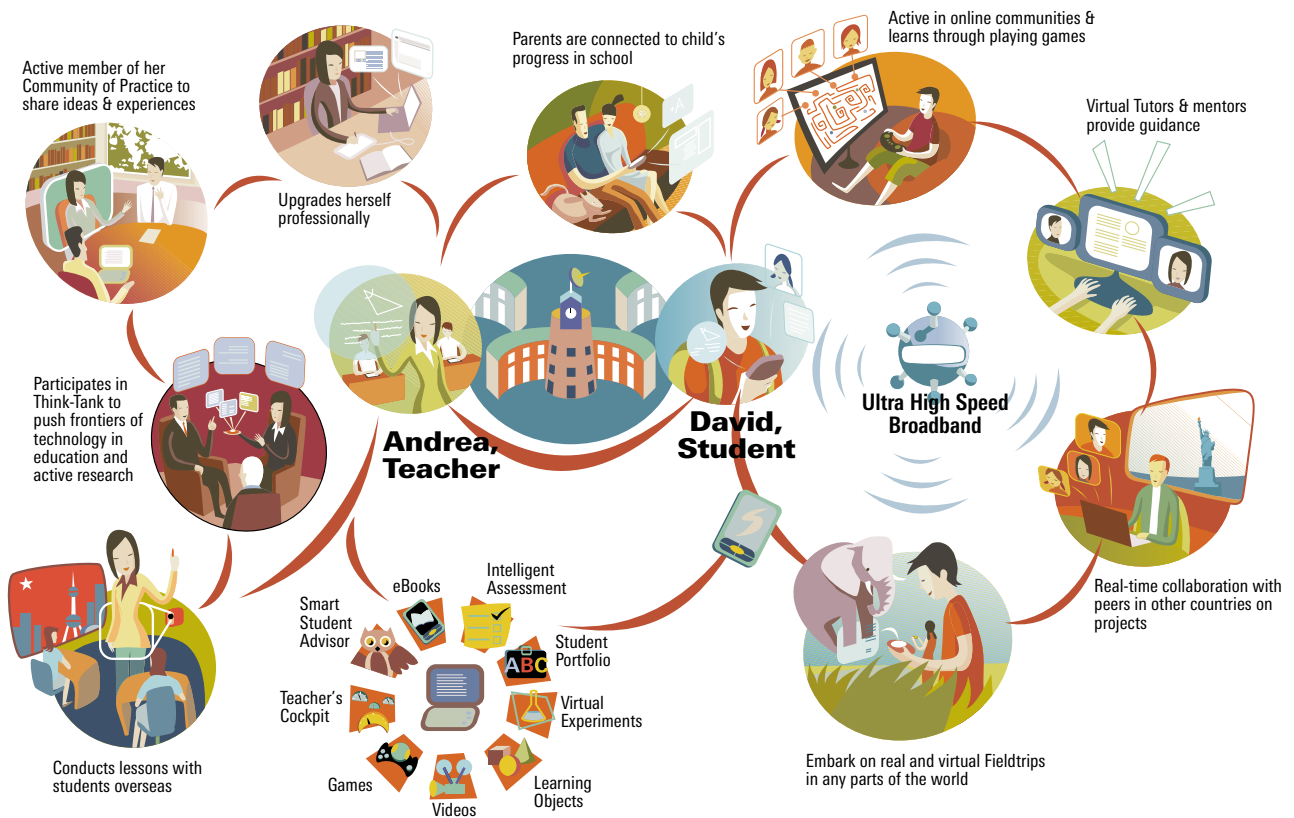Empowering Learners and Engaging Minds, through Infocomm

Figure 3-1: Possible learner's world in 2015

CHAPTER 4
GOAL, OUTCOMES AND STRATEGIC THRUSTS

Goal

The goal of the iN2015 Education and Learning Plan is to foster an engaging learning experience to meet the diverse needs of learners in Singapore, through the innovative use of infocomm.

Outcomes

The Education and Learning Plan aims to achieve the following outcomes:

- Our people experience engaged learning and enriched lives, and Singapore benefits from enhanced national capacity;

- Our educational institutions, with their pervasive and innovative use of infocomm, are magnets for global talent; and

- Our infocomm industry is recognised for its innovative Education and Learning technology products and services.

Strategic Thrusts

Singapore needs to maintain her leadership in Education and Learning as a critical national competitive advantage, especially in the area of public education. This is best done through the strategic use of infocomm in Education and Learning, especially by the major education providers, such as MOE schools and IHLs, who will provide the leadership and market size to catalyse developments across the entire sector.

Through these efforts, demand for infocomm products and services will be created, spurring innovation and R&D agenda by infocomm companies and research institutions. Efforts in catalysing the use of infocomm in Education and Learning will be boosted by developments in the national infocomm infrastructure and manpower. IDA will also work with industry players to build capabilities amongst infocomm local enterprises (iLEs) to capture the spin-off values from our efforts.

A SWOT analysis on the Education and Learning sector was conducted to identify key strengths and inhibitors facing our Education and Learning sector in meeting the iN2015 goal and outcomes.

STRENGTHS

- Strong foundations in the use of infocomm for teaching and learning in public schools
- Infocomm-savvy learners
- Reliable, pervasive and trustworthy infocomm infrastructure
- Strong international reputation of education system
- Multi-cultural setting creates exportable infocomm products and services

WEAKNESSES

- Capacity for deeper integration of infocomm in teaching and learning still developing
- Relatively low penetration of high speed household broadband access
- Lack of relevant digital content for teaching and learning
- Small and fragmented industry faces difficulties when expanding overseas

OPPORTUNITIES

- Tapping on the lowering cost of computing devices, personalised learning devices could be provided for learners
- Leveraging on the strong reputation of our education system, proven education infocomm products could be localised for export to emerging markets (e.g. India, China and Middle East)
- Building on our strong education system, we can be global leaders in the areas of learning sciences

THREATS

- Other countries investing heavily in this area will reap significant competitive advantage
- Larger markets elsewhere may attract the development and test-bedding of new infocomm technologies for education and learning if Singapore does not maintain her thought leadership

In achieving the iN2015 goal and outcomes, the greatest leverage will be in spurring demand for the strategic use of infocomm in the Education and Learning sector. The following three Strategic Thrusts have been developed to achieve the iN2015 Education and Learning goal and outcomes.

- **Strategic Thrust 1** – Creating an enriching and personalised learner-centric environment in our educational institutions;

- **Strategic Thrust 2** – Building a nation-wide Education and Learning infrastructure; and

- **Strategic Thrust 3** – Positioning Singapore as a centre for innovation in the use of infocomm technologies for the Education and Learning sector.

Strategic Thrust 1 creates a broad base of infocomm usage in our educational institutions, while Strategic Thrust 3 develops peaks of excellence, with innovation as its focus, serving as beacons for the wider Education and Learning community.

Strategic Thrust 2 puts in place key components of the Education and Learning infrastructure to support the programmes under Strategic Thrust 1 and Strategic Thrust 3. These horizontal infrastructure components will focus on enhancing the connectivity between learners for collaboration and enabling greater access to rich digital content. This will leverage on the nation-wide infocomm infrastructure put in place by the iN2015 Infocomm Infrastructure, Services and Technology Development report.

In addition, the infocomm enterprise development efforts for the Education and Learning sector will leverage on the recommendations of the iN2015 Enterprise Development Sub-Committee in supporting their internationalisation and export efforts. Similarly, the development of capabilities for infocomm manpower to support the Education and Learning sector will be addressed by the iN2015 Infocomm Competency Council report.

Strategic Thrust 1:

Creating an Enriching, Personalised and Learner-centric Environment in our Educational Institutions

In order to maximise the potential of our learners, the learning process, experience, activities and resources will need to be customised to their learning style and aptitude. Owing to resource constraints, it is not possible to do so on a large scale with traditional teaching practices. However, the integration of infocomm technologies into the learning process and environment can bridge this gap and provide an enriching and personalised learner-centric experience for each student.

To achieve this, the Sub-Committee proposes the following four areas of focus:

- The use of infocomm technologies to support a wider range of pedagogies in our educational institutions;

- The development of new learning resources and new infocomm-enabled assessment modes;

- The building of capabilities of teachers, school leaders and curriculum planners through harnessing infocomm technologies; and

- The setting up of incubator educational institutions that will spearhead the use of infocomm technologies to support engaged learning.

This thrust applies to the entire range of educational institutions within the Education and Learning sector and should benefit as many learners as possible.

Building a Nation-wide Education and Learning Infrastructure

At a national level, there is a need to enhance the connectivity between learners and enabling greater access to rich digital content to support the changes in the Education and Learning sector. In this respect, we have identified two key areas to focus on. They are:

• Make high-speed, pervasive and cost-effective broadband access available for teachers and learners in our educational institutions. Besides high-speed access, connectivity anytime and anywhere is essential to enable learning to take place beyond the boundaries of the classroom; and

• Make available easy access to relevant digital content. Leveraging on interactive digital content from various local and overseas sources, learners will then be able to enhance their learning experience through simplified and illustrated explanations of difficult concepts.

Life-long learners outside the formal education system should also be able to benefit from timely and convenient access to digital content in any area of interest.

Strategic Thrust 3:

Positioning Singapore as a Centre for Innovation in the Use of Infocomm Technologies for the Education and Learning Sector

Singapore, which prides itself as a knowledge-intensive economy, has to continue to be at the forefront in the use of infocomm technologies for Education and Learning. We need to place emphasis on active research in this area. This will result in better-informed policy formulation and planning, and effective implementation of initiatives across the Education and Learning sector.

Innovation too will help differentiate Singapore from other economies which have larger market sizes. By being innovative and being at the forefront of real-life deployment, Singapore can serve as a reference site for infocomm companies and research institutes.

It is also critical to support innovation and enterprise at all levels of the education system, especially to strengthen the link between research and practice. Therefore, we propose the following areas to be looked into:

• Forging strategic partnerships with key companies and research institutions in this field, and locate test-bedding, prototyping and Research and Development centres in Singapore;

• Developing a Research and Development agenda across the education technology research community, educational institutions and the industry, focusing on new technologies and models for harnessing infocomm in Education and Learning; and

• Building capabilities within the infocomm industry to support research and innovation within the Education and Learning sector and enable this to be a key export engine for the industry.

Opportunities will be provided for the infocomm industry to be recognised as a world leader for innovative Education and Learning infocomm products and services, especially in emerging growth markets that look towards modelling themselves after the Singapore education system.

Innovation is Key

"Innovation, enterprise and R&D, these are the ways to remake the economy."

Lee Hsien Loong, Prime Minister and Finance Minister, Singapore in his National Day Rally 2005 Speech

CHAPTER 5
GETTING THERE

EdVantage Programme — Empowering Learners and Engaging Minds, through Infocomm

EdVantage will be the key programme to be implemented to meet the iN2015 Education and Learning goal, outcomes and strategic thrusts set forth above. It builds upon our past efforts in the Education and Learning sector and involves the collaboration with partners from the industry and government agencies like MOE and NLB.

The EdVantage programme has a strong focus on infocomm usage in our public schools as this is where we mould our young in their formative years and where they acquire life-long habits of infocomm usage. It is also where we instill a spirit of life-long learning in our young by exciting their passion for learning at an early age. EdVantage is aligned with and supplements MOE's on-going efforts in mp2.

The EdVantage programme aims to strategically deploy infocomm in Education to provide a learner-centric, collaborative environment that extends beyond the classrooms, thereby enabling a diverse and vibrant schools landscape in the use of infocomm. The programme adopts a "broad yet sharp" approach. It builds a broad base of high usage of infocomm in our schools.

This effort will involve significant changes in classroom and school practices. The conventional model of learning based on textbooks and a didactic approach will evolve to one with greater use of digital learning resources and a more collaborative learning culture.
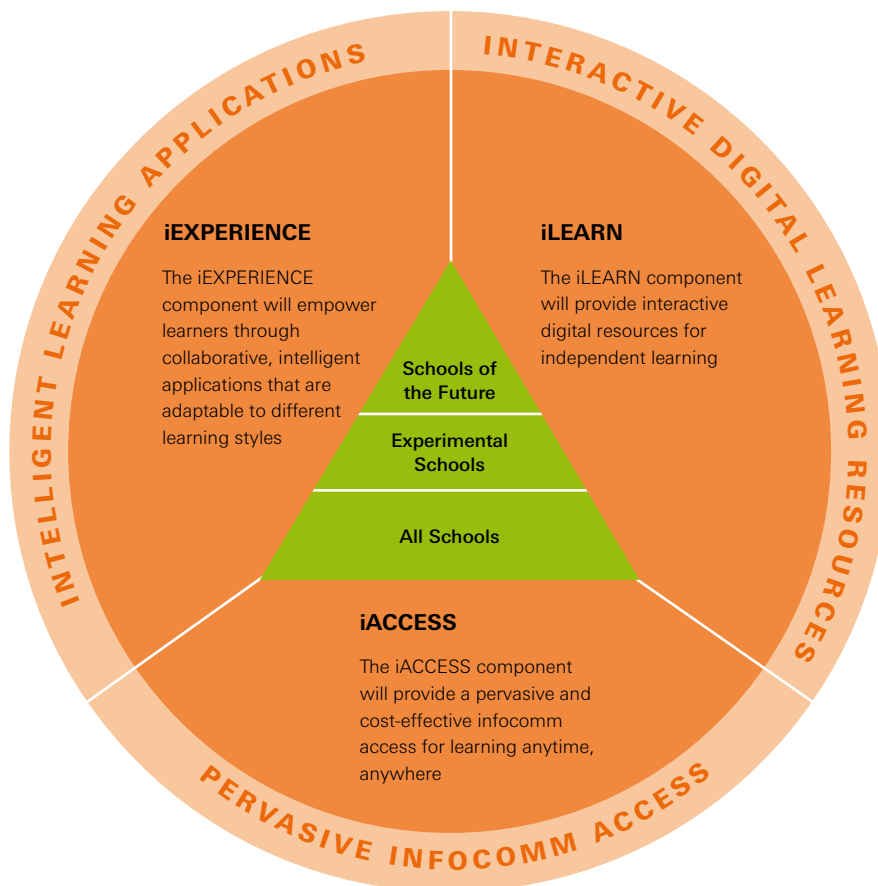

Figure 5-1: EdVantage Programme

The learning process can be transformed through harnessing infocomm through the following three components:

- **iACCESS** will provide a pervasive and cost-effective infocomm access for learning anytime, anywhere;

- **iLEARN** will provide interactive digital resources for independent learning; and

- **iEXPERIENCE** will empower learners through collaborative, intelligent applications that are adaptable to different learning styles.

To ensure pervasive nation-wide deployment of infocomm, our schools will need to build up their capacity for technology planning, integration and implementation. While all our schools will become competent users of infocomm, the EdVantage programme will also aim to develop several peaks of excellence on this broad and strong base, so that the leading schools act as beacons for the innovative use of infocomm in education. These Experimental Schools, which form 15-20 per cent of the schools, will be the test-bed for the innovative use of infocomm in teaching and learning and become pathfinders for the rest of the Education and Learning community.

Another five per cent will be exemplary in their integration of infocomm into learning, while experimenting with emergent technologies that will become more widely used in the future. These schools will be mentored and co-sponsored by our infocomm companies and education technology research community partners and they will enjoy a holistic learning environment infused with advanced infocomm applications in all aspects, from school design to management to teaching and learning. These schools will be transformed into real-life 'Schools of the Future'. They will serve as beacons of innovative infocomm usage in the education setting for Singapore and beyond.

While Singapore cannot compete on the basis of its absolute market size, it can create a sustainable differentiator for itself by having authentic exemplars of infocomm integration in its *Schools of the Future*. These schools serve as reference sites for major infocomm companies and research institutes interested in creating products in the education and learning space, especially for overseas markets.

Components of EdVantage

Possible projects under each of the EdVantage components have been identified. These proposed projects are not meant to be comprehensive. These plans would need to be revised from time to time to account for advances in educational practices and technology.

iACCESS

To provide a pervasive and cost-effective infocomm access for learning anytime, anywhere, the following projects should be included.

One-to-One Computing

To fully realise the benefits of an infocomm-enriched learning experience, the learner should be equipped with a personal computing device. Recent global projects, such as the MIT's One Laptop Per Child initiative, are moving towards this direction to make cheaper learning devices a reality.

Singapore should leverage on these developments to deliver an affordable and adequate Personal Learning Device for all learners in Singapore. To realise One-to-One Computing, IDA should identify and address key issues such as deploying suitable devices, and putting in place appropriate financial and deployment models.

Wireless Campus

In this project, the entire school compound will be transformed into a giant wireless hotspot for learners and teachers to roam and enjoy seamless Internet connectivity. This gives learners greater ability to exercise their independence as they manage their own learning, taking learning beyond the boundaries of the traditional classroom. Under the Wireless Campus project, IDA should work with schools to deploy and support broadband and wireless infrastructure.

Learner on the Move

The Learner on the Move project will allow learners and teachers to stay connected to the Internet beyond the school compounds, making collaboration easier for cooperative learning. For example, learners can access content and discuss with peers in other locations when they are on a field trip. This initiative will leverage on the deployment of a next generation National Infocomm Infrastructure (NII), arising from the recommendations by the iN2015 Infocomm Infrastructure, Services and Technology Development Sub-Committee. One major component of the next generation NII is the nation-wide pervasive Wireless Broadband Network (WBN), where industry partners will provide seamless wireless connectivity at major business and residential centers at affordable prices. In addition, the project will also aim to provide connectivity in more areas to ensure learning hotspots (such as nature reserves) are covered and that education subscription plans are also available.

Learning@Home

The Learning@Home project will align with another key project of the next generation NII, which is the next generation National Broadband Network (NBN), where learners at home will be able to enjoy ultra-high speed and symmetric broadband access at affordable prices. This opens up new, exciting possibilities for teaching and learning, as greater collaboration and improved speed of interaction between local and global learning communities can be achieved.

iLEARN

The iLEARN component aims to use a wider variety of interactive digital learning resources in schools to inject authenticity, currency and richness in the content used to engage learners. In this way, learners can conduct independent learning suited for their individual learning styles. The following describes the proposed key projects of this component.

Interactive Textbooks

The interactive textbooks build on past efforts with key publishers, where static and conventional print-based content is turned into digitised forms for more flexible learning. These efforts in developing digital textbooks, with embedded multimedia resources, have enabled several schools today to use this new repertoire of tools that teachers are open to adopt as part of their instructional approach. These digital textbooks will be deployed in more schools.

By adding more features, interactivity will increase to support flexibility in pedagogies, e.g. teachers can customise lesson plans by incorporating modular multimedia content from different textbooks and supplementing with their own notes; and textbook viewers can have read-back functions, especially for second languages, which are complemented with synchronised highlighted text. The project will involve working with publishers to refine the features for further enhancements and look into deploying the next generation textbooks for several core subjects in schools.

Learning Digital Exchange

On top of the interactive textbooks, the demand for available supplementary digital learning resources is growing. To meet such needs, an exchange for access to relevant educational content will be developed. The Learning Digital Exchange (LDX) project aims to enhance learners' and teachers' access and enable the sharing of digital resources online, not only amongst themselves but with different commercial providers. This network of content will also link up with public resources from libraries, MOE and NIE.

A phased approach will be adopted for the LDX deployment to better understand implementation challenges such as digital rights management, intellectual property (IP) rights clearing house and search-and-access across different types of repositories. The project will start with enabling schools to share their digital resources aligned with curriculum and 'personalised' to different levels.

Digital Games for Learning

Digital Games for Learning is a type of learning resource, largely touted to benefit learners in the Internet generation, who are becoming less engaged with traditional classroom teaching. Games offer learners to be involved in an experiential environment that encourages strategy development and community-based collaboration. It acts as a learning tool that is adaptable to different learning styles in extended periods of focused activity.

Our schools are keen to explore and use games to motivate learners while achieving their learning objectives. They are keen to work with the industry to produce suitable pedagogically sound games linked to local curriculum. Hence, games will be an opportune area for schools and industry to collaborate and develop export potential. This project could start in pilot schools before scaling up to more schools.

iEXPERIENCE

The iEXPERIENCE component aims to engage the learner through the use of a number of learning applications in schools to transform the learning process. By integrating reflection, collaboration and feedback mechanisms within a learner-centric environment, the peers, teachers and parents are also more involved to provide quicker response in the learning journey. Key proposed projects are described below.

Learner Portfolio

An application to help personalised learning is the Learner Portfolio, which is made up of the learner profile and e-portfolio. A learning profile helps to define the characteristic behaviour and performance displayed by learners. The e-portfolio is an electronic learning record, i.e. inventory of an individual's skills, knowledge and achievements. An increasing number of schools are exploring the Learner Portfolio in various forms, e.g. capturing project information online and saving projects into CD-ROMS. They are beginning to see the value of giving learners a memento of their achievements and activities during their learning journey, e.g. during personal development planning and for lifelong learning.

The project will need to involve schools to show the continuity in Learning Portfolios when learners move across school levels as well as to demonstrate how a portfolio can be used to plan and monitor a learner's all-round development, e.g. mentally, emotionally and physically. The key issues that will need to be addressed include technical portability (across different media), storage and archival as well as inter-operability (across different platforms).

Infocomm in Assessment

Assessments help the learner to clarify their thoughts, test their understanding, communicate and demonstrate what they know and can do to the teachers and themselves. They are also a means to provide feedback to the teacher on how the teaching approaches, strategies and programmes

can be modified to help the learning. Infocomm technology can play a part in increasing efficiency and adaptability of existing assessment modes. For example, with the digitisation of existing assessments, learners can request to take the tests only when they are ready, thus giving them greater flexibility to pace themselves.

There is an increasing emphasis on the learning processes and not just final outcomes. New modes of assessments will therefore be needed to assist in the evaluation of the learner. Infocomm technology can also be leveraged to expand the scope and nature of formative evaluation. For example, complex problems can be created and presented in multiple modes – video, audio and text – instead of single-dimensional mode through pen-and-paper. With simulation and modelling, interactivity between the learner and tasks can be enhanced, thereby, enabling the learner to learn difficult concepts and develop deeper reasoning and analytical skills. The learning process can then be captured and evaluated to enable the teacher to diagnose the clarity of the learners' thinking processes.

The project will look into identifying and prototyping infocomm enabled assessments.

Learning through Collaboration

Schools are interested in cooperative learning, where small groups of learners are encouraged to work together on common tasks and coordinate their efforts to complete the tasks to meet shared goals. With pervasive infocomm access, learners are able to collaborate better through mobile learning applications. Information is shared and accessed anywhere anytime, i.e. at home and even public places like community centres, parks, libraries, museums and the zoo. Field trips can be integrated into the learning experience (i.e. pre-trip research, trip data collection, post trip follow-up), with follow-up homework done at home.

Collaboration through online interactive activities is a key feature of the engaged learning environment. It improves communication among peers, teachers and parents as learners receive feedback and are able to adapt faster to changes. In this project, 'peering' schools will be identified to form virtual learning communities of practices, online tutors and digital mentors. For example, learners could seek opinions from and discuss viewpoints with experts in other locations during an outdoor lesson.

Implementation Approach of EdVantage

EdVantage works best when all the key elements are in place. Given the current levels of infocomm usage, all schools in Singapore should be developed to a stage where there is more pervasive and integrated usage of infocomm for teaching and learning.

The school leadership sets the tone and leads the school in harnessing infocomm technologies for teaching and learning. Schools will need to build up their capacity in technology planning, integration and implementation of learning applications and content. It will be important for a support mechanism to be put in place for schools to tap on to meet their needs. Technical consultancy will need to be made available to enable them to reach a higher level of infocomm use in schools, to provide the technical guidance and advice needed for the development and implementation of their infocomm plans. At the same time, sharing of good practices among schools will also help them in their adoption of infocomm for teaching and learning.

Singapore needs to continually innovate in the use of infocomm for teaching and learning. In this regard, 15-20 per cent of the schools will be identified to be pathfinders for the rest of the Education and Learning community by experimenting and deploying innovative applications of infocomm for teaching and learning. These schools could undertake research in the use of emerging infocomm-based pedagogies as pockets of experimentation. These schools would also implement innovative or effective use of infocomm-based pedagogies, showcasing the scalability and sustainability for other schools to adopt.

Finally, there will be five per cent of the schools identified as the peaks of excellence that integrate infocomm holistically in all aspects of the school environment. The active participation by the public and private sectors will be needed in the development of the *Schools of the Future* to turn them into beacons that will position Singapore as a centre of excellence in the use of infocomm in education internationally. Partnerships will need to be forged among the local education technology research community, infocomm researchers, industry partners, and renowned overseas education technology institutions.

These partners will benefit from the deep deployment of advanced infocomm applications in a real-life school environment, where real-time feedback and adjustments in products backed by sound research can be achieved. Mentored and co-sponsored by partners, these schools will have advanced learning environments that are based on latest infocomm technologies and refreshed on a regular basis. Such tie-ups will result in a vibrant exchange of ideas and collaborations that will benefit both the partners and our schools.

In addition, to drive experimentation of innovative applications in our schools, a regular forum comprising education policy makers, practitioners, researchers and infocomm companies will be set up. This forum will establish an Education and Learning infocomm *Innovation Agenda* to guide a call-for-ideas process, through which new ideas for the use of infocomm in teaching and learning can be harvested. This *Innovation Agenda* will also spur the development of new infocomm IP by industry partners.

CHAPTER 6
CRITICAL SUCCESS FACTORS

In order to implement the EdVantage programme successfully, the following critical success factors need to be addressed:

- **School Readiness**

  Schools must recognise that infocomm is essential for learning. Schools must be willing to embrace the culture of sharing information with one another, and to learn from each other in order to improve themselves. There must be leadership and clear support from school leaders. They must show the ability and readiness to harness and integrate infocomm practices and technologies on a school-wide basis. Teacher capacity needs to be developed to use infocomm effectively. MOE has been working to enhance readiness among its teachers and school leaders under its mp2. IDA should work closely with MOE in addressing these areas;

- **Technology Readiness**

  In order to effectively propagate the use of infocomm in schools, technologies must be cost-effective and readily available for adoption to fully enable and support an environment for all learners; and

- **Industry Capacity**

  Besides the importance of building the capacities of teachers and learners so that they are able to innovatively and effectively harness infocomm, it is also critical to build the manpower capabilities of the infocomm industry.

Building Leadership Capacity

"Technology is not innovation in itself. We all know that. What really matters is how teachers themselves use technologies and software to craft and deliver lessons, and push their students to learn in new and sometimes unplanned ways. That's where the real value comes from when we use IT in education."

Tharman Shanmugaratnam, Minister for Education, at the launch of the First Innovative Chinese Language Portal, 2006

CHAPTER 7
LINKAGES WITH OTHER iN2015 SECTORS

To address the critical success factors of Technology Readiness and Industry Capacity, the iN2015 Education and Learning Plan will leverage on the recommendations by the iN2015 Infocomm Infrastructure, Services & Technology Sub-Committee and iN2015 Infocomm Competency Council.

iN2015 Infocomm Infrastructure, Services & Technology Development (IISTD) Plan by IISTD Sub-Committee

Arising from recommendations of the iN2015 IISTD Sub-Committee, Singapore will be deploying a next generation National Infocomm Infrastructure (NII) which consists of 2 key components – the next generation National Broadband Network and a Pervasive Nation-Wide Wireless Broadband Access.

To enable a seamless and collaborative learning experience, the iN2015 Education and Learning Plan can leverage on these efforts to provide learners and educators with cost-effective, pervasive and high-speed infocomm access through broadband and wireless connectivity. The Education and Learning sector can be one of the first major users of the Next Generation NII.

iN2015 Infocomm Manpower Development Plan by Infocomm Competency Council

As highlighted above, the capacity of educators in using infocomm effectively for teaching and learning is a critical success factor. The Infocomm Competency Council has recommended an Infocomm Competency Development Plan which targets to develop competencies needed by the various sectors. The iN2015 Education and Learning Plan can leverage on this effort to enhance the infocomm skills required by both in-service and pre-service educators.

In addition, there is a need for education technologists, who can integrate infocomm into education processes such as pedagogy and assessment, and who can advise policy makers and educational institutions on their infocomm plans. IDA could explore with the National Institute of Education on the feasibility of establishing an Education Technology undergraduate or Masters programme for interested educators in this area.

IDA can also work closely with the schools and IHLs to support the students' interest in infocomm through the Student Infocomm Outreach Programme under the iN2015 Infocomm Manpower Development Plan. Through this, IDA will be able to expose our students to the possibilities enabled by infocomm to spur greater innovation, as well as attract top talents into the infocomm profession to ensure a long-term critical pool of quality infocomm manpower.

iN2015 Enterprise Development Plan by Enterprise Development Sub-Committee

Building on the reputation of Singapore's education system, our infocomm enterprises have the potential to be global players for education technology products and consultancy services, especially in emerging growth markets such as Middle East and China.

Singapore should capture the economic spin-off to our infocomm industry from our investments in the Education and Learning sector. This can be achieved by facilitating the development and deployment of innovative Education and Learning technology products and services by our infocomm enterprises and helping these enterprises to market these products and services overseas.

This approach is aligned with the iN2015 Enterprise Development Sub-Committee's recommendation to spur infocomm IP creation, branding our "Made-by-Singapore" infocomm products and helping our iLEs to expand into overseas markets.

Application Innovation
The proposed Education and Learning infocomm Innovation Agenda will provide clearer indications to infocomm enterprises on the near-term focus areas by the Education and Learning sector, as well as provide partnership opportunities between the infocomm enterprises and schools that are interested in experimenting and prototyping these applications.

IP Creation
The development and deployment of these innovative infocomm applications in schools will provide opportunities for infocomm enterprises to generate IP and implementation experience, which are backed by real-life implementation. This is aligned with the iN2015 Enterprise Development's Sectoral Projects Partnership Programme, which enables infocomm local enterprises to partner with MNCs to jointly develop sectoral solutions.

Global Branding

The international reputation of Singapore's schools arising from their innovative use of infocomm provides opportunities for Singapore-based infocomm enterprises to leverage on this branding as a platform to market their education technology products and services overseas. These companies can tap upon iN2015 Enterprise Development Plan's "Made-by-Singapore" Infocomm Branding Programme to build this global branding.

Internationalisation

Besides the export of Education Technology products, the infocomm industry can also capture significant economic value from providing Education Technology consultancy to foreign governments. The iN2015 Enterprise Development Plan's e-Government Solutions Export Programme can be used to facilitate such overseas engagement.

Application Innovation

Education and Learning
Developing Innovation Agenda

Internationalisation

Enterprise Development
e-Government Solutions
Export Programme

Global Branding

Enterprise Development
"Made-by-Singapore"
Infocomm Branding Programme

IP Creation

iEXPERIENCE   iLEARN

iACCESS

Education and Learning
EdVantage Programme

Enterprise Development
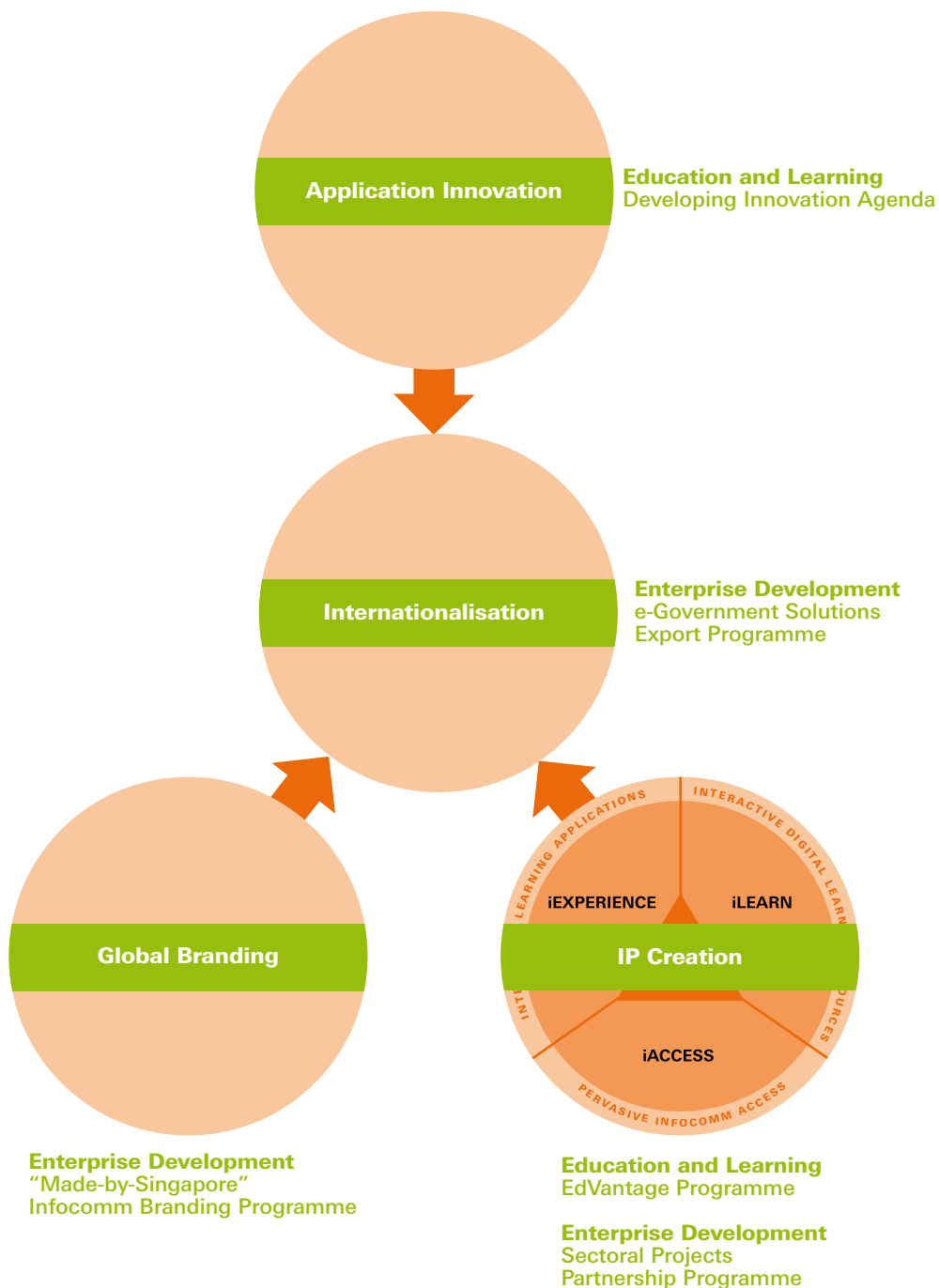Sectoral Projects
Partnership Programme

Figure 7-1: Representation of Linkage Areas between iN2015 Education and Learning Plan and Enterprise Development Plan

CHAPTER 8
CONCLUSION

Education and Learning, especially in our young is essential in maintaining Singapore's competitiveness. The innovative and effective use of infocomm in this sector is a key enabler in transforming the teaching and learning experience, and better prepare our children for a more dynamic and uncertain future. In this area, Singapore has built a strong foundation with our past efforts and is well poised to make quantum leaps to enhance our national capacity.

The Education and Learning report attempts to provide a brief glimpse into how teaching and learning would evolve in the future, and the possibilities that could be enabled by infocomm. This provides a starting point for the development of the strategic thrusts, strategies and nearer-term initiatives to bring us closer to the envisioned iN2015 Education and Learning landscape and the goal of fostering an engaging learning experience to meet the diverse needs of learners in Singapore, through the innovative use of infocomm.

The transformation of the sector is an on-going journey, requiring the strong partnership of the public, private and people sectors. The Sub-Committee hopes that this report will be able to spur greater innovation in the sector to foster an engaging learning experience among the learners in Singapore.

Annex A: IDA Secretariat for Education and Learning Sub-Committee

Name	Designation
Ms June Koh	Assistant Director IT in Learning Infocomm Development Authority of Singapore
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Mr Ong Lih Tar	Consultant iN2015 Secretariat Infocomm Development Authority of Singapore
Mr Tan Kiat How	Consultant iN2015 Secretariat Infocomm Development Authority of Singapore

Infocomm Development Authority of Singapore
IDA is committed to growing Singapore into a dynamic global Infocomm hub. IDA uses an integrated approach to developing info-communications in Singapore. This involves nurturing a competitive telecoms market as well as a conducive business environment with programmes and schemes for both local and international companies.
For more information, visit *www.ida.gov.sg*

Singapore Computer Society
SCS, established since 1967, is the premier professional body for IT practitioners and IT users in Singapore. With a membership of over 22,000, it is an invaluable network for its members. SCS administers various certification programmes that help individuals gain professional recognition for career development.
For more information, please visit their website at *www.scs.org.sg*

Singapore infocomm Technology Federation
SiTF is Singapore's national infocomm industry association. It brings together 500 corporate members from MNCs and local companies, who collectively account for over 80% of the industry revenue. The SiTF assists its members in business development, market intelligence, overseas trade missions, networking and alliances.
For more information, please visit their website *www.sitf.org.sg*