Lycée Technique Nic. Biever

College in heart of iron and steel industrial area of 18000 inhabitants, today however more diversified employment with growth of new small and middle sized enterprises but 47% of population remains working class.

School consists of 1150 students enrolled 2000/01. More than one-third of which are foreign (20 nationalities of which Portuguese predominant), this a similar proportion to other technical high schools in Luxembourg.

This high school contrary to what its name suggests is not strictly technical and also comprises a section of general secondary education.*

Th school building is undergoing expansion with 89 students in secondary cycle and 856 in secondary technical cycle and with 205 in attached preparatory section.

137 Teachers.

This study only reflects on the students engaged in the technical cycle.

ITC in the school

This school is quite advanced in terms of ITC equipment as opposed to other schools. It has 4 computer rooms, a total of 118 computers, an Intranet system permitting each user a personal password with space on the main server, an e-mail address and possibility to publish their own personal home page. The National Education authority provides replacement of hardware and faulty equipment every 3 years. Technical problems and breakdowns remain a daily maintenance problem to which there is not yet a satisfactory solution.

On the whole ICT is well integrated such as the initiation of basic technical computing and applications which relate to future employment (i.e. office). However, integration of ITC in main stream is under developed. This is due partly to a lack of equipment, the 4 computing rooms are usually always occupied, and also due to the reluctance of teachers and constraints of programmes in the different branches. In certain courses ITC is used to explore new pedagogical approaches and/or where these innovative projects necessitate computer support. All students at the school in the cycle inférieur do a basic course in computing and all have the possibility to free surf after hours. However, this does not mean that all students profit equally from technical equipment. The benefit of the basic course is reinforced most effectively in cases where students use ITC outside of school hours. Not all student possess home computers and these are not necessarily used for learning. Use of school equipment outside of school hours in under exploited. Wide gaps of computer competence exist therefore between students in the same class. The teachers interviewed agree that the advantages of ITC are evident and that students must learn to use it. ITC, however remains just another teaching tool, complementing the traditional teaching resources.

Innovation of school s integration towards the outside community

The structure of the OECD study permits comparison of ITC evolution with that of pedagogical innovation in the school classrooms. In Luxembourg, this poses a problem on the one hand due to the fact that technical high schools have an extremely divided structure, which reflects the variety of technical training offered, and, on the other hand because the different course programmes are fixed by the Minister of Education and do not allow much of a margin for

specific local structure. It is also generally agreed by the school management of LTNB that the definition the pedagogical innovation in the last few years has been inclined towards an opening up of the school towards the outside community. These have been heterogeneous efforts and don t fit into a common pattern. These initiatives however respond nevertheless to pedagogical practice being of primary importance, such as seeking professional aid, training periods/instruction in companies, relations with parents, local community contact and opening up to the word via the Internet.

Both ITC and the innovation to open up to the outside community of this school are making a very slow progression, the school web site is eternally under construction . However the evolution is positive thanks to dynamic teachers encouraged by the management. Future development is assured and various students reinforce this trend.

2. <u>Recent developments and their origin</u>

Progression of school s integration towards the outside community
The opening up of this school towards the outside community did not start on a specific date. Only for the purpose of this study was this analysed along with the innovation of ITC. Only broad outlines of the history of this innovation can be traced and not specific dates.

In the recent past, two influences can be noted:

- The first is the *Projet d etablissement* introduced by the Minster of National Education in 1990, giving schools the opportunity to engage in a more autonomous pedagogical approach, providing it brought about improvement across the board. LTNB introduced workshops and outside parallel school activities led by teacher and outsiders.
- The school s concern to move closer towards the working community by putting into place training instruction periods/stages in companies surpassing those usually offered.

The success of these implementations is due to enthusiastic teachers supported by the school management, together with the aid of the national structure (reinforced by the Projet d etablissement) which provides schools with the means to participate in obligatory training periods within companies.

However, the evolution is not current in all aspects:

- The workshops of the first *Projet d etablissement* have been nearly all discontinued,
- The successive initiatives for specific projects vary depending on the availability of the most engaged teachers,
- Concerning the opening towards the outside community, there is evidence of narrowing contact with outside companies, but this differs with different sectors of teaching and classes,
- Concerning the opening up towards the family community, there are difficulties with contacting parents, systemising approaches, parents more prone to intervene when there is a problem.

The implication of teachers in the opening out initiative

These do not have a uniform profile. There is a 10-15% core group of dynamic and motivated teachers, who are engaged year-after-year in diversified activities. The same co-ordinator of the first *Projet d etablissement* took on the second with same group of followers engaged for one or other reason. Generally it can be said they form a very heterogeneous group with teachers from all sectors, both genders and representing all ages. Their common motivation was for personal interest. The school s efforts for opening up towards the outside community met with no notable opposition. Even though there were non-participating teachers it was their free choice. The main obstacle was overload of work and other commitments as the collaboration of these large ambitious projects required a lot of time on a voluntary time difficult to assume on an on-going basis. This was particularly felt in the European projects with exchange schools, the availability of teachers diminished progressively and above-all due to administrative work load a project of this nature requires and supplementary hours of work involved.

The evolution and implementation of ITC by the teachers

Pioneers

This began in the 80s when the Ministry of National Education began to equip high schools with computer labs, offer computer courses for teachers and introduce computer courses for students. Pioneer teachers at this stage were very few, mostly males consisting of different age groups but who had specific training in subjects such as mathematics, physics, chemistry, economy and were motivated by computer programming.

The first computer teachers were those of mathematics, due to the fact that the Ministry began only afterwards to engage teachers with IT diplomas in schools. LTNB had the rights to its first qualified IT teacher at a time when technological equipment was progressing with hallucinating speed. At this stage however, students were not yet really implicated, excepting a few in programming, office or computing skills directly relating to their studies.

Beginnings of a cross- culture

The situation changed with the introduction of Windows facilitating IT classroom use. Easier word processing encouraged more students to use the computer. In particular language teachers and others began to close the previous gap and teachers of all ages and genders (with exception of the oldest teachers) warming to it so that the teaching group using ICT became more heterogeneous and numbers increased.

Rivalry to create the best page layouts for homework project descriptions and working tools became evident. Many were incited to purchase home computers to prepare their lessons, most notably language and human sciences teachers began to integrate ICT into their courses. In the sciences there were still no software programmes suitably adapted or easy to use for teaching these subjects. Computers predominantly used by the teachers for their private preparations at home for school lessons.

INITE courses

At a national level the increased use of ICT created the need for an introductory IT course called INTE in all high schools. This was obligatory in the first cycle (3 years) comprising of 2-3 hours per week following an interdisciplinary manner teaching basics of computer skills applied in a given branch of teaching. Normally the course was prepared in the classroom by a

teacher in the general stream (like language) and then the practical application in a computer lab. This method responded to the teachers in the general stream who did not want to introduce ICT in the classroom without technical assistance. Over time this interdisciplinary method was not found to be practical and replaced by an introductory course given by the IT teacher.

At LTNB the mixed method has been maintained and the pedagogical advantages are evident. Most participating teachers are around 45 years and male, but there is not a lack of female participation. Mostly those who already had used a PC at home and at ease in computer use. Thanks to their innovative spirit the little pedagogical projects could be put into place within the classroom, however these are unrecorded. Over the years it became more and more difficult to recruit professional teachers competent to give the INITE course, so that more and more the courses were given by teachers not familiar with ICT or unenthusiastic. It generally remained that the mainstream teachers volunteered, but their numbers did not increase as it was seen to be the same teacher year in and year out taking the initiative.

Web for school

Another important step in the middle of the 90s occurred when computers with internet access became available at LTNB. From this moment ICT was no longer considered the domain of specialists or specially interested persons. The majority of teachers were attracted to the potential of Internet and there was an increase in the number of those starting to use the computer for multi-purposes.

The installation of internet at LTNB was due to an initiative our outside experts. Members of the local Linux club, pushed by being a service orientated club offered voluntary service to put a network of computers into the school so that all pupils could have access to internet. The Linux club installed themselves in the basement of the school as of 1993 to develop the necessary equipment in collaboration with a school teacher. Several years onward, the work of this highly qualified voluntary group became integrated into the *Project d etablissement* in the form of the name Web for school . The *Project d etablissement* enabled credit investment and human resources to the school notably in the form of IT Teachers, mathematics and science teachers and other mainstream teachers. In this manner equipment and organisation of the introductory computer courses was facilitated with the introduction of an internet basics course for teachers, students and parents.

The first Linux computers were installed in the library and a number of teachers made use of these for the purpose of documentary research in relation to the subject they taught. Then the demand for introduction of Internet into the computer labs was called for. Gradually labs with Intranet were installed with access to Internet and Linux facilities to use popular programmes such as Word, Excel and Access.

Training

The Ministry of National Education organised at a national level the training for the first teachers to give computer courses in the mid 80s. Following this the Ministry continued to offer a large number of introductory courses and specialised courses in Windows, Excel, Access, PowerPoint etc. LTNB did not offer anything supplementary to this within the school other than initiation courses to the Internet under the Web for school *Project d etablissement*

umbrella.

According to the interviewed persons, it was most by self-teaching that they learned to use the computer, either complementarily to the offered Ministry courses or alternatively. Aid from friends, colleagues or students themselves also being precious. At the school teachers reached out to colleagues who volunteered the role of resource personnel, these however became rapidly inundated with the demand of soliciting advice. A certain amount of expertise was gained on the task whilst giving the INITE course where teachers ICT skills developed with those of their students.

Many Internet courses during the period 1998-99 were organised under the Web for school *Project d etablissement* umbrella. Some 40 teachers were implicated with others by their own means. These initiation courses were not centred on specific applications in the different branches of teaching.

Obstacles

Reluctance of teachers

Estimated that between 20-30% of teaching body remain unfamiliar with using a computer, of which a large number are women, those close to retirement and language teachers. These offered the following explanations for their reluctance:

- fear of technical difficulties,
- refusal or impossibility to invest necessary time to initiate themselves,
- no immediate need in their private or professional lives,
- refusal to become dependent on the new technology
- feeling of helplessness in front of an ever evolving technology, so that can never keep up-to-date,
- general reluctance towards new innovations.

Other teachers use ICT for private use or to prepare their lessons, even though they do not wish to integrate ICT into their teaching. The main reason is lack of equipment and the 4 computer rooms are almost always occupied for the computer courses, so it is not possible to use ICT for other general courses. It is estimated though that even with more adequate equipment no more teachers would make use of ICT in their courses for the following reasons:

- Scepticism to the value of ICT to the quality of teaching, and worry that students will spend too much time in front of the screen,

- Fear of technical difficulties, frustration due to host of technical break-downs during the courses, demotivation of internal and external experts in charge of the development of the internal network system, no permanent technical assistant, not enough computers so that students have to work 2-3 to a computer, inability to arrange work in groups in the labs due to the set up, too large numbers of students per class for effective use of ICT, too short period of lesson time (50 minutes); the INITE programme reduces the possibility to combine initiation of computers with other branches of teaching,

- Insufficient technical competence felt all round,

- With regards to pedagogical methodology, not enough information on possibilities, lack of suitable software, lack of know-how on how to approach basic projects and work in groups, too much time involved to implicate, to prepare and plan with colleagues,

- With regards to human relations, , not used to this interdisciplinary method or work in

groups, divergent views and antagonism experienced between colleagues during a common course.

Teachers on the whole at LTNB are not anti ITC, those who do not wish to use it continue preparing in their traditional methods, and some just use it at home to prepare lessons. The do not feel pressurised to use it as the labs are almost always occupied and the evolution of students with home computers to do their homework is relatively recent.

Technical problems and internal controversy
The installation of a cheap and reliable Intranet system, thanks to Linux and the collaboration of voluntary external experts and teachers interested in ICT has caused controversy between the persons implicated. Linux is not a tradition in Luxembourg high schools, only after successful implementation at LTNB was this module adopted in other high schools. The official national programme prescribes various software and Windows the system had to be consequently adapted. These constraints brought about new technical difficulties adding to those that one normally experiences when installing a new network in a school. This caused many breakdowns in spite of the reputation of Linux for its reliability.

Some incompatibility was experienced with RESTENA the National Education Research Telecommunication Network as this network relies on a permanent liaison with all classical and technical high schools in the country. RESTENA wished to install a central security system with firewall to certain sites for all schools, this was not possible with the Linux system at LTNB who had their own private system of protection.

The technical problems that arose were much more difficult to solve than either the external experts (Linux club members) and the internal experts (teachers in charge of implementing the network) envisaged. Also the school lacked permanent technical staff to solve these general maintenance and technical problems, so that the computer teachers found themselves overwhelmed with this responsibility as well as teaching. The frequent break-downs and maintenance problems added towards a negative image to other teachers and demotivated them to integrate ICT into their teaching courses.

Apart from exasperation in front of technical break-downs there was not consensus among the external and internal experts or between other teachers on how to handle the situation. There were those who wished to see a sophisticated technical back-up and those who just wanted the simplest reliable equipment solution. There were also those persons so taken with computing that they were ready to consecrate hours of their time and those who wished for good functioning equipment but not prepared to give up hours of their spare time for this.

Over time the situation has eased with the addition of supplementary computing staff and better dispersion of tasks. Break-downs are less frequent. There remains however the presence of non-functioning equipment and there is not a system in place in the school for replacement, which remains a frustration. The role of the external experts remains controversial, even though their merit is recognised. Most interviewed persons agree that the conflicts that have arisen could have also taken place between internal staff, but it remains a delicate situation having external volunteers in a public establishment for something so vital such as ITC. This problem

was even more evident when the school wished to use the Intranet for administrative purposes and transmit confidential files.

Introduction and installation of ITC: the foundations are assured

The efforts of LTNB to install ITC and open up the school towards the outside community are partially inseparable:
- sometimes at the level of the persons implicated, as the core group of teachers engaged have mixed objectives,
- sometimes in a more accessory fashion in that Internet was used by pupils to document their future careers or to contact outside companies for training courses,
- sometimes in a more substantial way in that IT was used in different classes in collaboration with the local community or to connect to other classes in other countries, Internet being considered a window to the outside world.

Developments did not always happen in a uniform manner. Some obstacles that could not entirely be resolved arose. But the evolution has been overall positive. In the last few years the progress of ITC has been further reinforced by the government funds to boost ICT equipment in a programme entitled *Média 2000*.

3. The situation at the time of the school year 2000/2001

Computer equipment

At the beginning of 2000 at the LTNB there were 118 installed computers
- 70 computers in the labs
- 8 in the model office
- 12 in the biology lab
- 2 in the chemistry computing department
- 2 in the physics computing department
- 2 in computing studios
- 2 in electronics department
- 4 in the teacher staff room
- 3 in the psychology service
- 5 in the administrative offices
- 2 in pedagogical assistants office
- 2 in technical services

Servers are installed in the basement of the administrative building and computing annex. There is an administrative server (Windows NT4) and principal Linux server with password access, an alternative Linux server, an experimental router/proxy Linux server with Internet security firewalls, a Cisco router which routes between Internet/RESTENA/CIE/school network/administrative network, an intranet Linux server and CD server (NT4 files).

All the computers are equipped with multi-media with the exception of around 20 which have no CD-ROM drives, but this is compensated for with Internet access and connection to internal network. The workstations use Windows NT4 with the exception of 2 computers in the staff room which are on Linux. The servers are Linux and Windows NT1.

For the past 4 years students have password access and each student has their own space allocated on the hard disk and email account and possibility to publish their own home page. All internet access passes by the school server which allows a certain control over abusive use.

The Ministry of Education replaces equipment every 3 years and also faulty equipment. Small repairs are carried out by maintenance staff in the computing labs.

The equipment as seen by the users
On the whole the interviewed persons esteem that the equipment at LTNB is advanced in comparison with other schools. They complain that the labs are always occupied by the computing courses and therefore ICT cannot be integrated into other courses.

The lab users criticise the inadequate number of computers per student ratio. Often they have to work in pairs or three to one machine. The layout of the labs does not facilitate working in groups either, it is too rigid.

All agree that an enlarged computing area is needed. Some teachers express the wish for students to be equipped with portables for use in the classroom. Others disagree in that the maintenance problems involved would outweigh pedagogical gains. Others are for workstations at each desk within the classroom. Others vote for a single classroom computer with projection facility.

Most interviewed agreed that in recent times technical problems have diminished. However technical problems remain a serious deterrent and disturb classes and waste precious time. The bad history of past technical problems also causes reticence to use ICT in the classroom.

The presence of permanent maintenance staff is considered to be an absolute necessity. These persons should be recruited into the school as opposed to liberating staff from teaching time to deal with these problems.

ICT Use

Integration into the school curriculum
During the school year of 2000/2001, ITC was used in the following ways in LTNB:
- INITE course, basic computing skills course (Word, Internet, Excel) for all pupils in first three years of technical secondary cycle including the preparatory class. This initiation course is combined with application into the general stream (see Chapter 2).
- Computing courses (programming) in certain superior classes,
- office courses (commercial administration, accounting, model office etc.) for certain superior classes,
- optional course with no fixed content, e.g.: creation of home page,
- in an integrated manner, for specific tasks like biology where they have their own computing area,
- in a punctual manner, in other branches if the computer labs are free, except they are very rarely unoccupied in reality.

In the 8th grade/class, an optional course exists to learn 10-finger typing.

On the whole it is considered that ICT use has been well integrated into LTNB concerning basic computer applications with a view to future employment such as office work. But ICT integration into more general use is less developed due to lack of equipment and reluctance on part of teachers and constraints of curriculum in different areas. ICT mainly used in other branches where projects necessitate computer support.

Internet use is modest and only recently part of the INITE course. Other special internet courses are given but outside of class time, similar courses are offered to the teachers as well as parents.
Outside of class time students can use the computer labs to free surf, they can do homework research or navigate internet according to their interests. These sessions are held for two-hours on one or two afternoons per week.

ICT use by teachers
A survey of ICT use by teachers was carried out in November 2000. The OECD questionnaire was given to all 137 teachers. Only 30.7% returned the questionnaire consisting of multiple choice answers requiring only 10 minutes to complete. The detailed results are in Appendix 2. Of the returned 42 questionnaires most of the contributors were at ease writing a text using the computer, communicating by email and web searching, but less competent with specialised tasks. Word processing the most popular use and tutorials nearly not used at all. Three-quarters of the teachers said their students made use of the Internet at least once for their courses. The majority used home computers regularly to prepare lessons, and made regular use of email, a third communicated with other teachers via billboards or forums. It can thus be deduced that the majority of teaching staff at LTNB by end 2000 used ICT only for preparation of their lessons or private needs, as those who did not respond to the questionnaire were even less likely to use it in the classroom to those who responded.

Examples of good practise
Despite the limited use of ICT in general at LTNB, from interviews there are examples of ICT use in a number of areas beyond those imposed by the official curriculum:

- In the INITE course during the last four schools years (1997/98   2000/01) the initiation of technology combined with the following branches:

- languages (French, German, English) 19 classes
- mathematics, physics, chemistry 13 classes
- music and art 13 classes
- biology, geography 11 classes
- history, economy 4 classes
- ADAPT (general classes   weak students) 12 classes

There is no documentation however on these interdisciplinary projects. But without doubt after the difficulties as described in Chapter 2, the Cupertino between computer staff and general teaching staff brought about enriching learning experiences for the students. An Internet research on the life of painters was regrouped on a data base as a result of such work.

- Training with a view to future employment: in the commercial office courses, teachers publish documents regularly on the school server and students are invited to download them from their personnel access. Students are also encouraged to undertake internet searches e.g. for a study on the insurance company market in Luxembourg and in the initiation course to commercial enterprise and in the course entitled model office which simulates a working environment with different service sectors of a commercial office, students use the computer to aid stock taking, sales, accounting, general administration (http://ltnb.lu:bureumo/burmo.html) some courses have simulated demonstrations incorporated.

- Specific projects: students have used ICT for specific project work and documenting on the web e.g.:

- an interactive photo story by the 8th grade:
(http://www.ltnb.lu/webmast/web/main.html)

- chemistry project by students in the 9th grade who published a series of questions on the web with the possibility of verifying responses but with the aim to aid inferior students to improve their knowledge in chemistry and physics (http://www.ltnb.lu/webmast/web/main.html)

- Integration of ICT in biology (this department hosts a dozen computers with overhead screen projection). The biology teachers at LTNB co-ordinate a project studying the diverse possibilities of ICT for biology at a national level (http://www.bommel.ltnb.lu)/. Didactic resources are recorded on the web such as:

- In the Remarkable Trees project where students in the 8th grade who opt for biology have recorded with the aid of a communal gardener the most remarkable trees that exist in the Dudelange town and have published photos and a description of each example on the web (http://www.ltnb.lu~arbres/home.html);

- In a lesson entitled DNA zum Anfassen 11th grade paramedical/social students downloaded a tutorial from the web with self-evaluation possibilities to familiarise themselves with DNA structure;

- In varies courses where students do research on the web or compile work notes, or where students use the projector to illustrate practical work.

Soon the Biology Department will be equipped to undertake experiments assisted by computer, e.g. take blood pressure or perform an electrocardiogram.

- Within training periods in companies, students use ICT at these companies, and have to obligatory submit reports on their stages on computer, they are incited to do neat presentations and make use of the web to document on the companies.

- Integration of ICT in other courses, apart from rare visits to the lab when they are free, teachers giving general studies use the computer at home to prepare their course, making course handouts, consult CD-ROMs and do document research on Internet. Some encourage students also to do homework using the computer, and for this students either use their own personal computers at home or make use school computers after-hours or computers at their local libraries, youth centres etc.

Teachers interviewed on the advantages and disadvantages of ICT mentioned firstly that ICT is a precious working tool for preparing or illustrating a course and that Internet and CD-ROM allows rapid access to a vast resource of documents and references that are regularly updated. Those who have integrated ICT into their courses have found a means to alternate the main part of the course with this new pedagogical approach which is more individually centred and adapted to stimulate student autonomy.

Among the cited disadvantages it was mentioned that a lot of time has to be invested in helping students work in a intelligent way. This calls for more preparation time and classroom time.

Student abuse of the material (deterioration of the equipment, access to unauthorised sites etc.) were considered annoying, but not a major problem at LTNB.

The students at LTNB

Advantages
Globally for the students, ICT represents such an advantage that they feel absolutely compelled to learn to use it. ICT represents a tool to facilitate chores for the student and open up new avenues. Internet also offers a vast potential of resources of information, documentation, communication and learning. Current information is readily accessible at little cost. The new resources can be used to do traditional homework, but also to explore new ways to work in a more autonomous fashion. At the same time ICT can favour working closer together between students and their teachers on projects. In general students like using ICT, and speak with enthusiasm about it, they are motivated by their work and this motivation with concern to ICT has not been seen to diminish over the years at this school. ICT represents for the youth something which is indispensable to their futures.

Disadvantages
Among the disadvantages risks that ICT represents to the young, most of those interviewed complained about the time factor spent in front of the screen instead of talking a walk in nature. The time invested to do a serious Internet research, and the time by diversions such as chat rooms and forums, time spent in electronic communication rather than personal interactions. It is also deplored that with ICT more time is spent on presentation than depth of work. There are also a large number of students who are lost faced with the mass of information offered on the Web when they have to perform research. Often random pages are printed from the Web, without analysis, understanding or even reading them. The adults also agree that for the most part students have difficulty to identify the difference between a good and bad quality sources of material, while the students themselves do no recognise this problem. There is fear that the youth access material that is not desirable, and that they do not recognise the danger, that they are targets for publicity and will be tempted to make financial engagements beyond their means. It is also noted that daily use of ICT can cause student stress when they are required to perform certain task when they are not sufficiently competent with using the equipment.

Most teachers agree that while homework presentation improves thanks to ICT the quality of

depth does not. ICT should not replace other traditional tools such as books. The quality of the work depends largely on the pedagogical framework, the available time and access to equipment and above-all to possession of a home computer. On the whole students are more motivated when using ICT aid, unless the subject does not interest them or they are frustrated due to their weak grades which will not get them into the desired field of work afterwards.

Competence
For the most part the teachers interviewed esteem that in general the level of computer skills is medium or good, especially with those students who also possess home computers. The level is estimated to improve dramatically over the next few years, as there still are big gaps in level of skill among students in the same class. After three years of the INITE course, the students have achieved a basic level (boot and shut down a PC and a programme/ read, exchange and save files, open and close Windows, distinguish between a hard and floppy disk, know the specifications of a local network and home directory, know the main applications such as Word, Excel, PowerPoint and Internet). For the most part the students are able to improve themselves in areas of their own interest, some of them becoming true experts in their field. But some teachers feel that students cannot yet apply their knowledge to concrete tasks, so that after 3 years of the course this will show improvement. Students themselves have mixed views, some said they managed by themselves as well as those that had followed the full INITE course, but most agreed they were slow at word processing as they could not 10-finger touch type. Some declared they did not yet feel at ease in front of the computer and could not do page layout properly, some complained the INITE course was too theoretical, with too much focus on Excel so that they had to learn long formulae. The interest of the youth is based on their own interests, but also the image of their future careers, but latter not always in line with the evolution in the real world. Some of the paramedical students did not realise that hospitals were so computer equipped and that nursing implied a certain ICT competence.

In 1998 the Web for School project undertook a survey at LTNB on their knowledge and interest in using Internet at school. 599 students responded, of which 83% confirmed to already have prior knowledge acquired during their normal classes at LTNB. Judged most useful was e-mail contact newsgroups and chat rooms at the top of the list followed by access to current information and documentation. Concerning their principal use of Internet 60% of students responded for accessing current information and 6% use for preparation of homework during class as opposed to 39% use it to prepare their homework at home. Few students make use of their email addresses at school, for lack of opportunity and that their mail is inspected.

Students with home computers
Students who possess home computers are able to exercise and perfection their ICT competence gained at school. All interviewed agreed that students with home computers were at an advantage which is further enhanced by parents who encourage their children to exploit the potential of ICT for learning and not just for playing.

The teachers at LTNB estimate that most of the students at this school possess home computers, be it their own or a family computer. Thos who have home computers do not necessarily have Internet access, although this number is increasing. This is reinforced by a survey carried out on 160 students by a computer teacher at the beginning of the year 2000/01

who attend his 9 INITE classes grouping students of the 7th, 8th and 9th grades of the technical high section (excluding preparatory regime). 79% stated they had home computers and 44% access to Internet.

There are assumed to be large variations in the different classes however. In the classical high school section where the largest percentage of students are from better social classes and almost all have their own PC, whereas at the technical high section it is estimated that the grouped classes have a lower figure than what is stated above, and in the preparatory classes which group mostly underprivileged students, it is estimated that more than half do not possess home computers. It is estimated that the financial situation of a family plays a large role as to whether a students has or has not a home computer, independent of nationality. But there are families with fewer means who offer their children computers by way of credit. Not all home equipment is however used for school learning, either intentionally or not. Sometimes software not compatible with the school, some are not at all equipped with software to do homework, notably due to cost response. A informal survey at end-2000 in a 10th grade class following an office course, revealed that of 24 students, only 12 had a home computer equipped to do homework on Excel. There are other families of various social standings who for one reason or another refuse to invest in a home computer.

But the above situation is constantly evolving, students using home computers for ICT increasing by the year. However, underprivileged students at LTNB are not rare and there is a problem in that they do not have home computers. To aid those students with no computer at home or Internet access, the school has opened its labs during certain hours. The most common formula on offer are the 2x per week free surfing sessions. Students can do their homework or navigate the web under supervision. Chats? Are forbidden. These seances are well attended but the number of students compared to total number of students who profit from it is little. The reasons are on the one hand the inability for students to remain at school after hours and limited offer of time and lack of publicity. The lack of the wish for students to remain at school after hours also explains the failure of other initiatives, such as the offer of some teachers to organise appointment access to the labs after school hours in order to do their homework.

Which students profit the most?
ICT has the most benefit to better performing students, often from families who are better off financially and have home computers, or to students from poorer socio-economic backgrounds with no home computers. The majority of teachers agree that ITC does not close the gap between good and bad students or students from different socio-economic backgrounds. The presence of ITC in the home has shown to be a distinct advantage, but the better students have more facilities to exploit the potential of ITC, locating Internet sources, reading, understanding and interpreting them an using it for personal use. The better students are better able to solve technical problems. Amongst the less gifted students there are those that are able to manipulate ITC purely from a technical standpoint without using their competency to improve at school or further their careers. Their inability to concentrate does not allow them to approach tasks in a structured manner and they are easily diverted. They are less motivated to spend free time in a computer lab or do serious research at home and even less inclined if their parents do no serve as an example in this domain. If the level of achievement at school is very low, the students are

equally slow at catching on to computing and following through to make use of it.

Only a minority think that ICT is beneficial for weak students. To succeed you have to give them new tasks, adapted to their level and stimulate their motivation. It is argued that good students always do good work, with or without the aid of ICT. It appears also that students help each other which reduces social gaps.

All teachers generally agreed that ICT is beneficial in one manner or another to all students with varying degrees.

Girls and boys
The vast majority of teachers interviewed were in agreement that the impact of ICT differs according to sex. This statement is not surprising in a country where the level of female employment is amongst the most feeble in Europe and the choice in high schools reflects largely the traditional professions.

LTNB comprises a total of 659 boys and 419 girls split as follows:
(excluding the 73 students in the technical section following an alternative training with a company apprenticeship).
Classical high school 89 students of which 57.3% girls
Technical high school (excluding preparatory) 782 students of which 38.5% girls
Preparatory regime affiliated to technical high school 207 pupils of which 32.4% girls

The majority of students at LTNB attend the technical high school: 481 boys and 301 girls. But boys and girls are not equally spread in the different sections. In a number of sections, there are less than a third of the same sex and in extreme cases, the 10th grade and 11th (paramedical and social section) there are 85% girls and in the 11th grade (general technical section) there are 7.1% girls and in the 10th grade XEL (electricians section) there are no girls to the 18 boys in the class.

In general fewer girls have home computers. This presumption on the part of the teachers is confirmed by the survey results from the start of the school 2000/01 year carried out by the computer teacher to his INITE classes of 160 students in total: 71.4% of girls and 82.7% of boys possess a home PC. There is no difference concerning the access of internet at home with 44.6% of girls and 44.2% of boys. The situation was found to be similar in this study, among 6 girls, 4 possessed home computers of which 3 had connection to Internet. No figures exist on the presence of ICT in the home according to nationality and the collected information is ambiguous with certain teachers being of the view that immigrant families are less equipped, but according to a Portuguese mother (Portuguese representing the largest group of immigrants in Belgium) Portuguese girls are better equipped than boys due to the fact that they do not have the same liberty to go out as boys and computers are a compensation.

The persons interviewed are unanimous in agreeing that in general, boys show more interest in ICT, boys talk more about computers, they buy specialist computing magazines, they do DIY on their computers, which girls never undertake to do and boys are more inclined to go attend

the free surfing sessions and internet initiation courses. Of the students interviewed, 2 boys of the 5 mentioned Internet amongst their favourite hobbies whilst non of the girls mentioned it as a hobby.

Girls and boys differ also in their approaches to learning the new tools, girls are more shy to initiate themselves to it and more inhibited by the technicalities in general, in case of technical difficulties or break-downs the girls turn towards external aid while boys try to resolve the problem themselves first, no matter what their competence level is. Over time the differences are less pronounced. If girls have had a certain reluctance initially they overcome with systematic learning solutions whilst boys have a tendency to bluff their way and overestimate their competence. But the biggest sex differences are visible in the extreme cases where students particularly gifted in ICT are nearly always boys and the ones who want to have strictly nothing to do with it are nearly always girls. Teachers signal that boys are often eager to help girls and show off that they are better. Teachers therefore avoid putting a boy/girl pair in front of the computers as the boys monopolise. Teachers also reveal positive experiences in all-girl groups who show more initiative and do not hesitate to ask questions (Orika course).

The teachers in charge of ICT instruction are male and female, with slightly different roles according to their sex. The four computer teachers and all the members of the pilot group of the *Projet d etablissement* Web for school are men. But in the INITE course given by a computer teacher together with a general stream teacher are both sexes: 52.6% men and 47.4 women during the four years comprising the school years 1997/98 2000/01.

At ICT usage level teachers do not see a difference between boys and girls in execution of the tasks confined to them. They only indicate that boys are more fascinated by Internet and are more tempted to navigate during a course or access forbidden sites. When they are free to navigate the web, girls and boys frequent different sites (e.g. cars for boys and pop idols for girls). Girls are more interested in the potential of interactivity of the Internet, the chat rooms and sending e-mails to pop stars, than playing computer games which excite the boys.

Initiatives of school s integration towards the outside community

For the purposes of this study comparison was made between the evolution of ICT and pedagogical innovation in the whole school. For this reason it was decided to define the pedagogical innovations at LTNB over the past year towards opening up of this school towards the outside community, notably the working world.

Openings to the working world
- Aid to steer pupils of the 9th grade

At the age of 15, students are required to make decisive choices concerning their future professional training and career. To aid students to guide the choice adapted to their capabilities, their interest and contacting future employees, the school has introduced since 1998 a pilot project for the 9th grade to open up towards the outside working world. This pilot project consists of the following steps:
- representatives of the Employment Administration come to the school to inform students on

course options for various careers, students perform a test on their professional interests, the results of which are discussed with a the Psychology service;

- After this preparation, the 9th grade classes visit the Luxembourg service for professional orientation and Employment Administration BerufsInformationsZentrum (BIZ) where each student documents their main interest.

- After the visit to BIZ, students are invited to test their presumed preferences in an orientation training period of between 1-2 weeks in a company of their choice. This stage/training course is obligatory for the students in the preparatory regime, and for the others it is a voluntary exercise undertaken during the Easter break. During an information evening, parents are invited to participate with their children. A teacher makes contact with the company and visits the students at their various work places. Students and employers sign a contract with the parents. At the end of the stage, the employers fill out a form stating the behaviour and aptitude observed. The school also requests the students to compile a report on their experiences and repercussions for future professional choice.

- At the end of the third trimester, BIZ has a special consultation booth at the school, inviting students to pass by individually, or if possible with their parents (booth open until 20:00) to inform themselves on possible apprenticeships and registrations with the Employment Administration.

In the near future the school intends to develop further efforts for orientation like pushing the parents to become more involved, and introducing evaluation of strengths and weaknesses of students before the 9th grade.

- Technician training for students in 12th and 13th grades

The training periods spent in companies for the students of the 12th and 13th grades who are training to become technicians is 4 weeks. This is written into the official programme, but LTNB applies special extra effort in this area to organise them under the best possible conditions to assure a framework of quality. The school has gained firm contacts with a large number of potential employees who are ready to employ student employment. These contracts re directly linked to the schools programme of the students concerned. All the teachers collaborate for the organisation of these training periods as part of their teaching tasks. Usually each student undergoing student employment has two tutors, one from the general stream (language, mathematics...) and one from professional training. The teachers make first contact with the company to decide what tasks the student employee will undertake. This avoids a student employee being abandoned and giving the company the responsibility to give instruction to the student; During the training the tutors visit the company in question and make an evaluation together with the person in charge of instruction in the company for the student. After the training, the student is requested to compile a report, which is presented orally in front of his/her class.

- Visits and training for paramedical students in 10th and 11th grade

Visits and training for paramedical students in 10th and 11th grade are also written into the official programme, for the 10th grade, two visits to a hospital are organised for the human sciences programme and for the 11th grade a training observation course of one week in a

hospital, crêche or retirement home, handicap centres undertaken. These contacts with the professional world are not as strong as those in the commerce sector, the school is in the process trying to make them more effective. These enterprises are overwhelmed with numbers of students for training periods, and cannot always ensure a person to oversee each student. This is why the school presses on teachers of the concerned classes to visit the sites and ask for evaluation from the staff at these sites to complement the student report.

- ● Other contacts with companies

The school also organises visits to companies. Teachers at LTNB help students to contact companies to find future employment.

Opening to the local community
The first *projet d etablissement* proposed to students support in their school work as well as different outside school activities/workshops in sports, music, photography, radio, video, chess etc., organised in collaboration with local clubs and national institutions. Most of these initiatives ended with the first *projet d etablissement* in 1995, but the spirit of opening up the local community continues.

The school participates regularly in round tables on subjects of employment with representatives of the community, local enterprises and the Business Federation and Employment Administration.

The school hosts exhibition, conferences and other events such as the Employment Week in the commune of Dudelange held in January 2001 and before that an exhibition on recycled waste and economising energy.

The school also turns to the local community for aid in organising cross-border projects for the students. It has also requested association of partnering with communities in other countries.

Classes collaborate frequently with communal services to specific activities which are initiated either by a teacher or the communal department. A number of projects carried out in the Biology course in collaboration with the local ecology service, such as the database of Remarkable Trees published on the school web site: (http://stadtbaeume.ltnb.lu/) and the Hello Spring project (http://spring.ltnb.lu)/.

The school was awarded the cultural prize of the town of Dudelange for a film made by the students at LTNB.

Opening beyond the local community
Teachers also invite experts to give a class, e.g., authors to present books for language course or history. Other classes visit museums, libraries, theatres, exhibitions in Luxembourg. The school also organises excursions and cultural visits to neighbouring countries. Lower grades can participate in the snow class in a foreign country each year. There are also contacts with foreign schools of which the Dinant high school and LTNB got to know each other by way of two teachers contacting each other via the Internet.

The *projet d etablissement* Web for School offered all students the possibility of using Internet long before this was a national norm. The aim of this was to offer also underprivileged students access to this richness of information. This move towards opening to the outside world via internet is also linked to local community in that the LINUXCLUB helped install the necessary technical equipment. After which these experts became integrated into the *projet d etablissement* which helped push technological advancement further, and training for teachers, students and parents. Initially it was envisaged to make the school server accessible to local associations to publish their home pages, but this idea was abandoned as new technologies allow each to provide a home page at little cost.

Opening towards the family
The school places great value on parental contact. At present this contact is limited to meetings as stipulated in the official programme, an open day in the second trimester, and one-to-one meetings with teachers and parents. To facilitate communication with immigrant parents, the school has begun to offer translation in French and Portuguese at certain meetings. Contacts with parent representative leaders are held in an Education Council and meetings with parent association. Less formal meetings are held during festivities, sporting events and others. Parents interviewed were of the opinion that the school in general was open to dialogue with parents and appreciated the ease for arranging a meeting with a teacher in case of a specific problem. The school proposes to intensify in the future contact between the school and parents, not just when problems arise.

Advantages and disadvantages of school s integration towards the outside community

All persons interviewed underlined the importance of the opening up of the school towards the outside community. In their eyes the disadvantages were not existent or minimal in comparison with the gains.

The efforts of opening up came as a breath of fresh air to prevent the school from closing up within itself. The school is not an ivory tower, but functions in a local, social and economic context and it is thus necessary to open up towards the exterior. Students enter into contact with new environments and learn things not taught in the school. This is both enriching and a source of new ideas, particularly so for students from underprivileged families who don t have in their daily lives the richness of experience and stimulating as others.

During the exchange programmes, students get to know youth from different backgrounds and used to a different way of doing things.

But it is noted that the opening up of the school towards the outside community is most beneficial when the young leave the school. The preliminary contact with companies is considered a huge help to face the professional world. During their training periods, the students gain a more realistic view of professional life. They may realise that a certain career does not correspond to their expectations and opt for an alternative. When the training course confirms their initial choice, they become more motivated to do well. They also have the opportunity to become familiar with the expectations of future employees, something which the

youth tend to ignore, e.g., punctuality, manners, presentation etc.

For the students the training periods with companies are very motivating and valued experiences. They return with more confidence as they realise they are capable of executing good work. The experience is further positive a great number of students have mediocre grades especially in languages.

The training in companies also permits the school to evaluate how well school learning prepares the students for professional life. The opinion of several teachers and parents is that the education system can profit in adapting their programmes to changes in the companies, above-all for classes that are preparing for a specific career. This applies also to the utilisation of ICT in the different fields.

The interviewed persons stated as disadvantages the risk that students might have difficulty to complete their school programme if their participation with the exterior lasts too long. This risk is not considered too great as these initiatives are either parallel to schooling or training periods in companies and linked to the school programme. Concerning the participation of a class in a specific project, it needs to be decided for each case where to draw the line between the projects and official programme.

A too great influence of a company over the schooling programme should be guarded against. It is noted also that the outside environment has difficulty in understanding the level of student understanding and speaks a language foreign to students.

The participation in projects and other measures in favour of opening up the school towards the outside community is only possible with a large voluntary engagement on the part of teachers over and above their teaching commitment. This engagement can be difficult to sustain, especially on large group projects and interdisciplinary approaches.

On an organisational level, it can be noted that administrative work is often laborious and school hours rigid (50 minute lessons) so that there is an obstacle of not enough flexibility.

But the main deficiency is that the measures in place in favour of opening up towards the outside community are still too modest. Some believe this is due to the constraints of the official programme which allow only for limited opening and others reveal that teachers are not in high enough number to invest as this opening up requires closer working with the students, a different method of teaching and motivation. For the most part teachers have no training for contact dealing with outside companies and are not ready for this adventure. The same goes for the availability of teachers for working in groups which is essential for project work.

Both parents and students appear from the interviews in the light of this study, to be little informed on the efforts of LTNB to open up towards the outside community. Concerning the opening up towards the family, there is still a long way to go, the school wishes to open up dialogue with parents who are not keen on school contact, whilst interested parents wish the school to communicate more openly with parents, including those who do not speak luxembourgeoise.

Student impact

The interviewed persons were unanimous that all students, whatever their grades or social situation profited from contact with the outside world. Some teachers felt that the impact depended on the personality and determination of the student, independent of their student performance. Other estimate the efforts were still underdeveloped and so their impact could only be modestly judged. It was also noted that all students, strong and weak could experience difficulties in new and unfamiliar situations (e.g.: presenting a project in public or writing a report) and that they rapidly achieve their limit, especially when having to work autonomously.

The question remains open as to whether good or weak students or students from poor or well-off families profit more from the policy of opening up towards the outside community, especially with the implication that students from a better social background achieve better grades. As there are no sufficient indicators, the persons interviewed are however reluctant to jump to conclusions too quickly.

The following reflections show that for the most part the better students and unquestionably those from underprivileged backgrounds that profit the most:
- the opening up of the school consists of offers where each one profits according to competence level;
- weak students risk to experience serious communication problems when they find themselves in different environments such as a training period in a company, being unable to express their wishes, ask what is required of them, alert that they do not understand, they do not react when reprimanded and do not take their own initiative and remain withdrawn in themselves;
- the access of different offers can vary according to the social family status, therefore less than 10% of the students in the preparatory regime participate in the snow class whereas there are about half of the technical high school and a large majority in the classical high school who participate. The same goes for other offers not obligatory in the school programme where extra costs to be borne by the family are required.

Other teachers underline the benefits that the opening up of the school towards the outside community can bring to weak students and those from poorer backgrounds:
- students who are unmotivated by theoretical learning can feel more at home in a company situation, in contact with machines and men in the working field;
- weak students can seize the opportunity not met at school and gain confidence;
- the stimulation of new and diverse opportunities is particularly precious for weak and underprivileged students as they possess many opportunities to develop;
- students become closer on the social level when they have the opportunity to work in groups.

On the whole, interviewed persons esteem that the opening up of the school towards the exterior does not close the gap between the good and weak students, as they all profit.

The interviewed persons to not feel that the opening up of the school towards the exterior varies according to sex. There are several differences which are noteworthy, it is generally more difficult to mobilise the boys for outside school activities. In the training periods with

companies it appears that the girls are more shy to react and when to perform tasks not laid out in the contract.

Until now the periods of training in companies have not brought about a diversification in professional choice. Girls and boys continue to opt for specific careers to one sex or another, conforming with tradition. Segregation exists in the composition of classes where according to professional specialists, there is inequality between girls and boys.

4. The OECD hypotheses

Hypothesis 1

At LTNB, as in all other technical high schools in Luxembourg the emergence of technical equipment available to students brought about the introduction of training for teachers, initiation courses in ICT for students in the *cycle inférieur* and specialised computing courses in different technical fields. With time as the technology became more common with word processing and access to Internet, and less prone to breakdowns, an increase in teachers interest to use ICT occurred, at least for their personal needs and preparation of courses. A similar evolution saw an increase in students with home computers as prices became more affordable.

In the initiation course for students INITE, ICT was taught by way of interdisciplinary projects, this was a new and innovative approach for Luxembourg. In this regard the technological equipment can be considered as a catalyst, although limited for the reasons that follow.

When ICT is considered at LTNB together with the pedagogical innovation of opening the school up towards the outside community, it is evident that ICT is a resource like any other and not a catalyst. The presence of equipment did not play a catalyst role in favour of ICT in the general stream due to this approach being still underdeveloped. The interviewed teachers reinforce the rival hypothesis in that they agree that students should know how to use ICT, but they have mixed opinions concerning the integration of ICT into the courses, ICT being considered as a tool amongst others, complementary to traditional resources.

Globally it can be said that LTNB supports the rival hypothesis.

Hypothesis 2

If the evolution of ICT is compared with that of the opening up of the schools towards the outside community, there are many similarities. In both fields the progress is slow. The principal protagonists were a core group of engaged teachers, motivated by their own interest and pushed by the management. This core group consisted of teachers of diverse ages, who were already experienced in their profession. The number varied slightly over time but remained limited. The majority of other teachers supported the efforts of the protagonists without themselves being much involved. A minority of teachers had nothing to do with ICT, but did not show opposition to their colleagues. In both areas, the evolution developed by way of institutional mechanisms imposed from above, the computer courses and training periods within companies offered to students brought about by the official programme and the *Projet d*

etablissement.

As the pedagogical innovation to open up the school towards the outside community was composed of a number of diverse initiatives without links to each other, it is not possible to push the comparison further. However, there are some differences apparent. The outside experts played an important role to equip the school with a computing network, whereas it was the school itself who initiated for the most part the efforts of opening up towards the outside community. The pioneers in the technological domain were on the whole male with specific training, whereas the promoters of the opening up of the school to the outside were of both sexes and from varied branches of teaching.

It is difficult to situate the evolution of ICT at LTNB in the Rogers framework. On the whole, the teaching body was homogeneous in terms of socio-economic and training levels. There are certain differences in their teaching status (professors, instructors, technical masters, trainees, leaders/head teachers etc), but the data collected for the present study only evaluates ICT for certain criteria. It is not possible to distinguish between the personalities of the early adopters and the late adopters , only that the latter do not correspond with the Roger s profile, the teachers reluctant to use ICT were not necessary opposed to the innovation in general, a multitude of other reasons explains their attitude. There are some facts which follow the traditional diffusion of innovations as described by Rogers, in that the teachers at LTNB are inclined to use ICT where they see it to their own private and professional advantage, they are also attracted by their more advanced colleagues, they initiate themselves when the software becomes more user-friendly and perfection their use by way of contact with colleagues, they participation diminishes when faced with technical problems and when the time invested seems to outweigh the benefits reaped.

It can be concluded that the innovation follows a traditional pattern of diffusion such as described by Rogers (1995). The data on economic factors and level of student use of ICT for those who possess home computers support this hypothesis (see sub.4 above).

Hypothesis 3
The situation at LTNB is not really favourable to answer this question. ICT is principally anchored in the school programme decreed for Luxembourg technical high schools, and the computing labs at the schools are almost always in full occupation to this end. The margins for manoeuvring are limited.

To support the rival hypothesis it can be stated that the computing network was put in place by outside experts who not only determined the profile of the *Projet d etablissement* s Web for school but also developed the technology infrastructure and offered the initiation course to Internet for pupils, teachers and parents alike.

However, it was the teachers who were competent and motivated who stimulated use of ICT in their classes, and they were the first to push the development in the school, after these pioneers, other teachers became initiated, notably by self-learning and from their colleagues. It is due to the engagement of these teachers that the interdisciplinary projects in the INITE course and exploration of other ICT application not included in the official programme happened. These

teachers put into place the *Projet d etablissement* s Web for school , and other specific ICT projects which were successful, and new pedagogical approach. On the other hand as interest of teachers diminished so did interdisciplinary projects in the INITE course. ICT is also little used in the main stream, not only due to lack of equipment, but due to reticence on the part of teachers who are not competent enough at ICT.

LTNB supports the first hypothesis.

Hypothesis 4
We first have to ask the question whether ICT could equally be accessible to all. At LTNB all pupils in the *cycle inférieur* of the technical high school does a compulsory initiation course in ICT. All pupils have the possibility of access to the free surfing sessions held after school hours. But this does not mean that all pupils benefit equally from the technological equipment. The effectiveness of the initiation course is greater when pupils exercise and use ICT outside school. Not all students possess home computers, and those that do not necessarily for learning, the use of the computer labs after school hours in under exploited.

The most competent students are the students with better grades and those that possess computers at home. Students from underprivileged backgrounds frequent weaker level classes and less often possess home computers. All interviewed teachers were of the opinion that students who had ICT access at home were at an advantage. They also esteem that this advantage is greater when the parents encourage or help their children to use ICT for learning. It is argued that good students possess more facilities to exploit the potential of ICT, e.g. find quality material on Internet, read, understand, interpret and use it to benefit in their work. Given that ICT is little used in the main stream, and that its impact depends largely on the quality of the pedagogical framework, these routes need to be verified on the basis of experience for the future.

All the teachers agree that ICT can profit in one way or another all students, but to varying degrees. They estimate that ICT does not reduce the gaps between the good and the bad students or the students from poor or rich families. It is generally felt that gaps between ICT use increase where ICT is not equally accessible to all students. But from the information collected at LTNB does not give a clear response to this question, so it seems that the gaps have a tendency to increase.

The question should also be posed as to whether ICT reinforces or diminishes the gaps between girls and boys. The data collected from LTNB points to fact that the impact of ICT varies between the sexes. Girls have less frequently computers at home and boys show more interest in ICT, girls and boys have also different approaches for initiation to ICT, using it at school and exploiting it in terms of the professional careers.

Hypothesis 5
As ICT use at LTNB is very limited and that its application in the main stream is rare, it is not possible to support either hypothesis. The teachers interviewed are opinionated on the advantages and disadvantages that ICT represents to their students, but their appreciation s to not allow for division between support for either one of the hypotheses.

5. Future developments

LTNB will without doubt continue efforts to develop the opening up of the school towards the outside community and use of ICT. These efforts will be done together with the policy of the Luxembourg Government and Ministry of National Education, Professional Training and Sports who are engaged at different levels for promoting ICT within schools and in daily life. The government has also in an agreement concluded in 1999 to attach great importance between the school world and that of companies and put into place adequate structures so that exchanges between the two sectors can take place in a regular and organised manner;

There is no doubt that the experiences of LTNB can profit other schools. The possibility to transfer between schools is amongst the criteria for the National Education to accord financial aid to *Projets d etablissement* or the Programme Media 2000 which allocates substantial funds to high schools for ICT equipment. Luxembourg also participates in international studies of which the present OECD study is one, to stimulate the exchange of information and good practise.

Desired developments in field of ICT
Interviewed persons expressed the wishes for the following future wishes to develop ICT:

Enhanced pedagogical value
Up until now, technical problems and lack of equipment have blocked the pedagogical debate on the use of ICT within schools. The question of how to use ICT and school and why? has been confronted by several specialists, but should now be addressed by the whole teaching body. It should include a critical view on the economic implications on school expenditure. It appears that the number of teachers who would voluntarily integrate ICT into their classes, even if the equipment was available, is low. For this number to increase, they have to be convinced of the pedagogical value ICT can bring to learning in their field and give them practical working models, put equipment at their disposition which is easy to use and problem free.

Organisation
Teachers new to ICT would be less reticent to integrate ICT into their courses if there was a technical assistant ready intervene in case of problems and to respond to helping students not yet able to use it. Class numbers are too big and this does not allow the utilisation of ICT for this new pedagogical approach which is more personalised and autonomous on the part of student. The 50-minute classes are too short and should be abandoned for a more flexible schedule. In traditional classes, one could record on a video the most vital classes and publish this on the school network, so that students could revise it at home. Students who do not possess ICT at home should be given more opportunity to use the school equipment outside of class time, during the recreation periods and when other classes are cancelled, and access to free surfing should be every day of the week and students should be incited to make use of these offers. National authorities should encourage teachers to invest more time and effort in the research of new pedagogical approaches with the aid of ICT.

Programmes

The commissions in charge of national programmes should define the possibilities of ICT use in the different sectors of teaching. Examples of good practise should be formulated for different courses; Globally, programmes should be more flexible to facilitate the pedagogical innovations with or without ICT. The initiation courses or use of technology tools should be based on practical application. In order to facilitate students initiation to ICT by self-learning, the Ministry should equip schools with French software, because students in the lower classes do not understand enough English to use the help in Word or Excel. Media education, including ICT, television, cinema etc., should also be integrated into other branches of teaching.

Training

To promote use of ICT, the national authority should offer student/teachers and in-service teachers concrete training in different teaching branches. As utilisation of ICT goes hand-in-hand with a new pedagogical approach, training should be given on methodology of working groups and projects. Some teachers express the wish also for training on networks and teaching responsibility in case of abusive use of ICT during class. As training attracts only a limited number of voluntary lifelong learners training should be supplemented by school meetings and pedagogical days.

Equipment

More efforts are needed to guarantee the smooth running of equipment and minimise break downs. The role of external experts needs to be clarified for future development. The need for supplementary equipment should be evaluated in light of need of usage and integration of ICT into the general stream. As the computer labs are still fully occupied, the school should equip itself with extra multi-media equipment. The labs should have a sufficient number of computers to permit each student to work at a single station. The opinion is divided as to whether the new labs need to be created or whether increase the decentralised equipment e.g. in the biology department into a new wing of the school under construction. Some teachers wish for students to be equipped with laptops which they can use in the classroom or computers in the work desks of each student, however other do not see any point in this. For the most part they express the wish for a central computer in the classroom with projection.

Maintenance

All persons interviewed underlined the importance of good maintenance of technological equipment. The current solutions are a long way from the situation some years back, but remain insufficient. The schools is in need of permanent technical staff whose unique task is to maintain the ICT equipment and help teachers with logistic problems. The whole computing system needs simplification to reduce the maintenance needs.

Communication/Management

The school network should be used to diffuse information and develop communication between different scholarly sectors and for administrative tasks. The national authorities should expand the computing programme to permit teachers to share their notes on bulletin boards. Some teachers wish for grades of students to be stocked on the school server to facilitate access by the persons authorised.

Other desired developments
In the eyes of the persons interviewed, ICT can only resolve certain problems in the school. The school also needs to evolve in other areas, failing this with the aid of ICT. The wishes concerning future development at LTNB at the school are notably the following:

Opening of the school towards the outside community
The opening up of the school towards the outside community is seen as of capital importance. This should be further enhanced, notably by way of contact with outside companies. The school should take into account, the experiences students have gained on their training courses and the continuing changing profiles of professions. Teachers need to become better informed on the realities of the different teaching professions. They need to communicate better with the outside world.

Student orientation
Through contact with companies, the school should make more effort to aid students to make a good choice in the future careers. Information and orientation to this end should begin earlier; The different initiatives should be co-ordinated to avoid isolated and short-term contacts and the orientation should be considered by all parts of the school as an indispensable part of the school programme.

Relations between teachers and students
Both parents and students underline human relations between teachers in students as being of fundamental importance, a student at ease with a teacher is more motivated to work and receptive to learn. For making the school a better learning place, communications need to be improved between teachers and students. Teachers need to become more individually involved with students and more empathetic. consultation hours should be perhaps implemented where students can consult teachers about problems at school or otherwise as most students will not take the initiative to contact their teacher.

Relations between the school and parents
The school should strive towards greater efforts to implicate the parents in the life of the school, especially those who are not mother tongue Luxembourgeois and from underprivileged backgrounds. The initiatives to open the school towards the outside community defeat the hesitation of parents to come to the school. The school should offer a framework for students whose parents work and cannot give their child adequate help. The state should increase financial aid to families with modest revenues and cannot afford necessary school equipment. The school cannot however aim to resolve societal problems and parents should assume their responsibility vis-à-vis their children.

Exchange between teachers
The school should create a structure which favours communication and exchange between teachers. Notably between teachers of the same class and same branches of teaching. Parents and students wish for exchange to ensure a better partition of tasks imposed on the students in the different classes.

New pedagogical approaches

Most of the teachers interviewed expressed the wish to see more know-how, concrete application of knowledge, development of key competencies, stimulation of the potential of each individual student, promoting autonomous learning, creation of an environment permitting students to experience pleasure in their work and confidence in their abilities. A reduction of the work programme and teaching and homework volume should be considered. There should be reduced numbers of students per class for a more personalised approach to be effective. Students wish for more stimulating courses and less punishment and more encouragement, fewer written texts, more discussion on subjects pertaining to youth issues of today. Parents demand also that the school initiate more personal initiative from the students and encourage qualitative evaluations in the classroom on performance and methods to overcome problems.

The new pedagogical approaches should take place in a more accommodating building and classrooms.

Organisation/programmes
Teachers demand a greater flexibility of programmes. Students request measures to facilitate transition from primary to high school and from one year to another, a greater harmonisation of programmes, and at the beginning of the new school year a recapitulation of principal teaching of the year preceding before introduction of new work. Some parents wish for increase in the number of weekly classes in the principal areas and make school obligatory until the age of 18 (instead of 15).

The ways of the future are therefore traced out and there exists already a solid base in the domain of ICT and the pedagogical innovation of opening up the school to the outside. The different actors in the school do not have a lack of vision for the future development of the school. All the cards are on the table for a positive evolution.