An Information and Communication Technology Curriculum for Steiner/Waldorf Schools

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Rationale

With very few exceptions our pupils aged 14 and over now have access to and use computers, the internet and mobile phones on a daily basis, and their actions are supported by an invisible network of electronic data handling and processing (transport, shopping, bookings, media, and so forth).

Steiner demanded that pupils in Waldorf schools gain an insight into the working principles of the technological devices they use at the time. Such insight enables freedom and judgment in their use. He was also concerned that pupils leaving school are equipped with the necessary life skills that enable them to take the step into the world of work or further education. Today there are firm expectations placed on school leavers with regard to Information and Communication Technology (ICT) skills from further education colleges, employers and, not least, parents and the pupils themselves.

The introduction and teaching of ICT in Waldorf schools in Britain and abroad has been largely left to the individual schools and, in most cases, to the initiative of particular teachers who happen to have the relevant interests and skills. Some schools have rejected the idea of introducing ICT teaching and computers on grounds of principle or due to lack of finance and/or skilled teaching staff. Where ICT teaching is happening, considerations such as what skills the students will be expected to have at a further education level usually determine the curriculum content.

The curriculum model described here is based on the perception that the time has come when our curriculum needs to integrate in a deeper and comprehensive way the reality of this technology that shapes our daily life. We need to be clear why we are teaching ICT in our schools, and the strands of the curriculum need to embrace the range of pedagogical and social aspects that we want to address in any subject taught in a Steiner/Waldorf school.

We accept the fundamental insight and pedagogical conviction that the teaching of ICT skills and the use of the computer as a learning tool has no place in our education for pupils up to the age of about 13 (class 7). There will be exceptions here for pupils with special educational needs. This means that in order to do justice to the expectations indicated above, the ICT curriculum in our upper schools will need to be given an adequate place in terms of time and resources to achieve its aims in the relatively short time span available.

The curriculum needs to set a number of fundamental objectives that can be achieved by each student:

- An understanding of the underlying scientific principles and technology,
- A historic perspective of the development of information and communications systems and their cultural significance,
- The development of an appropriate range of computer skills,
- The use of these skills creatively in a variety of subject and life skills contexts,
- The constructive working together with others in the use of ICT for more complex tasks,
- An awareness of the social, cultural and personal impact of this technology, and
- The ability for critical review and judgment of one's own and others' use of this technology.

In the present model these objectives give rise to the six curriculum strands outlined below.

Curriculum Strands

Strand 1 – Understanding the Technology

This strand will be addressed largely in main lessons and practical blocks, particularly in classes 9 and 11. Topics include an understanding and, wherever possible, hands-on practical work on: coding, binary and other number systems, algorithms for arithmetic/logic operations, electromagnetic and transistor switches, logic gates, simple circuits for bi-stable, adder and decoder, electromagnetic information storage, the working of the processor unit, components of a PC, printers, CD-ROM, visual displays, the basic technology of telegraphy and telephone, networks, the Internet, and virus and other security technology.

This strand is strongly embedded in the middle and upper school maths and physics (technology) curriculum and will usually be taught by these specialist teachers.

Strand 2 – Historic Perspectives

This strand will usually be addressed hand-in-hand with strand 1. It gives historic and social depth and significance to the emergence (and loss) of these man-made 'tools.' This will include topics such as number, letter and image representations, forms of writing through various cultures, forms of human communication from beacons to the Internet and the personalities associated with such inventions, the development of calculating devices from the abacus through Pascal's early calculating machines to modern computers, and the emergence of firms such as IBM, Microsoft and Cisco.

Strand 3 – Developing Computer Skills

This covers the systematic acquisition and practice of computer literacy skills. In most instances this will be best addressed in concentrated initial blocks of skills teaching in group sessions, using an ICT room. Applications skills will include typing, word processing, spreadsheet, desktop publishing, spreadsheet databases, and using CD-ROM and internet for study resources as well as email, and may go on to presentation software, relational databases, HTML and web page design, specialized graphics and CAD software. It will also address the handling of printers, scanners, digital photography and possibly other multimedia forms.

As there is usually a huge diversity of previous experience in this field, student groups will often need to be formed on the basis of this criterion. Critical review of the student's own approach and standard of work is to be cultivated. The practice and reinforcement of what has been learned is difficult to achieve without open access to the ICT facilities for the students. Experienced ICT teaching staff will be teaching this component, using 'real' materials and tasks as much as possible.

Strand 4 – Using Computer Skills in Other Subjects

Developing applications skills is no end in itself. The skills are to support pedagogically relevant tasks and projects in a number of subjects. This requires that as far as possible subject teachers have a certain level of ICT capability. Opportunities where ICT can support and enhance work include maths investigations, media studies in English, project work across most subjects (including class 8 and class 12 projects), and science investigations (planning and write-up including use of graphs). Again, this aspect is difficult to foster without open access to the ICT facilities for the students during break and study times.

Strand 5 – ICT Supporting the Development of Life Skills

Beyond the use of ICT in other subjects, it can serve a range of issues and activities in which the student is creatively involved, possibly outside of

school. This may range from club activities, drama groups, award applications, careers explorations, work experience placements, college applications, and job applications. Indeed the whole realm of business studies and citizenship offers a focus to combine the development of ICT skills with vocational and life skills. This curriculum model suggests providing such a specific focus. This lends itself to working creatively and critically in smaller or larger teams and on more complex tasks such as setting up an enterprise. Open access to the ICT facilities for the students during break and study times is an essential prerequisite here.

Strand 6 – Health & Safety, Security, Legal and Society Issues

Almost at every instance of using ICT, issues such as these crop up: How do I care for my and other people's health when using computers? How do I recognize that I'm heading for addiction or repetitive strain injury? What are the implications of generations who have grown up on violent computer games? Who 'owns' the program I'm using? Who has access to what? Who will use the personal information I am disclosing? Why do we have a new operating system every 2–3 years and a spiralling escalation of speed, memory, and so forth, in our PCs? What are the prospects of cyber-terrorism? These questions will be looked at formally and informally on many occasions. This curriculum proposes to give these a special focus in classes 8 and 12.

Outline ICT Curriculum in Steiner Waldorf Schools

Curriculum strand	Class 8	Class 9	Class 10	Class 11	Class 12
1 Understanding the Technology	Number systems (10, 2, 16 base etc). The abacus. Algorithms for arithmetic operations.	Electromagnetism; relay switch; simple circuits with relays (AND, OR, NOT switches); truth tables; circuit diagrams for bi-stable, adder, decoder with truth tables. Magnetic storage (tape, disks). Elements of a PC (motherboard, CPU, RAM, disk storage, peripherals) Dismantle and rebuild a PC. Technology of telegraph, telephone, Internet		Semiconductors, transistor, gating chips (AND, OR, NOT); Build bi-stable, decoder, counter, adder with gating chips; Machine code programming. The myth of the 'intelligent computer''. Technology of printers, CD-ROM, CRT monitors, TFT screens.	Networks, IP/TCP, LAN, WAN Network security, data backup strategies; Virus protection, firewalls Broadband internet access
2 Historic Perspectives	Coding (Roman, Maya, Egyptian, Indian numbers; Morse code, ASCII code)	Development and cultural significance of Communication: Beacons, runners, books, newspapers, telegraph, telephone, internet; Faraday, Morse, Bell, Pentagon, Cisco.		Development of calculating devices: Abacus, Pascal, Hollerith/IBM, Intel. Development and cultural significance of information systems: from Babylonian writing, hieroglyphs, text to graphic design, web design, computer-generated film and art; virtual reality.	
3 Developing computer skills	Learn to (touch) type (at home and in breaks at school); Basic PC and Windows handling skills; Basic word-processing. Find relevant and good quality reference material from CD-ROM and Internet.	Concentrated course on word-processing, spreadsheet, spreadsheet databases, DTP; Windows file system and management.	Digital photography, scanning, image processing, printing; DTP; internet, email.	Presentation software. Write simple HTML web pages; Integrating different applications documents.	Optional: Relational databases; website design; specialised graphics software, CAD, control software.
4 Using computer skills in other subjects	Use CD-ROM and Internet reference material for class 8 project (if passing a typing speed test, pupil may write up project on computer).	Use ICT skills in some subjects (English, history, geography, science, maths)	Use ICT skills in many subjects; coursework, maths investigations (eg functions, iterations), main lesson projects	Use ICT skills in many subjects; English (media), coursework, maths investigations (eg fractals, chaos theory), main lesson projects. Follow modern developments eg in biotechnology, current affairs on internet.	Use ICT skills in many subjects for coursework, projects etc. Class 12 projects.
5 ICT in support of life skills		Preparing class trip or other outings, play programmes etc. Exploring careers options with careers resources program.	Course on life, careers, citizenship, business skills; working through a range of documentation items (letter styles, CVs, logos, job applications, job descriptions, adverts etc.	Project: to set up and present an enterprise (in groups), creating logo, leaflets, letterhead, advert, job descriptions, agenda for board meetings, development plan, web page	College, job and UCAS applications.
6 Health & safety, security, legal and social aspects	Copyright issues; health issues; good posture; The role of computers and communication in society.	Copyright issues; health issues; good posture; The role of computers and communication in society.			The role of computers in society. Corporate interests/influence Intellectual property rights; Protecting Privacy - Data Protection Act; Protecting the enterprise
Suggestions for Timetable allocation	1,2: 10 main lesson sessions in class room (part of a maths main lesson?) 3, 6: block of 10 single or 5 double lessons per group. 4: Occasional supervised access to ICT room in breaks or project lessons.	1,2: 3-4 week technology main lesson block (additional technology ML block on power and transport!). 3, 6: 6 week block of 1 single lesson per day per group or half year 1 double lesson per group (30 Lns). 4,5: Regular open access to ICT facilities in breaks or as part of some subject lessons.	3,5: 6 week block of 1 single lesson per day per group or half year 1 double lesson per group (30 Lns). 4: Regular open access to ICT facilities in breaks, study periods, or as part of subject lessons.	1,2: Electronics practical and media main lesson (3 weeks). 3,5: weekly double lesson for half year per group (30 Lns) 4: Regular open access to ICT facilities in breaks, study periods, or as part of subject lessons.	1,6: 3-4 week block of 1 lesson per day (whole class) or half year 1 lesson per week. 3: Optional club 4,5: Regular open access to ICT facilities in breaks, study periods, or as part of subject lessons.