Standing at the threshold of the second decade of the 21st century, an educator might be disheartened to discover that the developments that were expected or anticipated in the school system have yet to materialize. The following table lists the characteristics (or lack there of) of the **School of Today:**

	School of Today	True or False
1	School is defined in time and space	✓
2	Students are grouped into grades by age	✓
3	The school is not an integral member of a larger community	✓
4	The school does not set out its methods of operation	✓
5	The school does not design its own curriculum	✓
6	The curriculum is not designed by instructors to cater for specific student needs	✓
7	In a school, instruction does not necessarily lead to learning	✓
8	The learning goals are not set by the students	✓
9	The content of the curriculum is predetermined	✓
10	Learners do not set their own learning goals	✓
11	The school does not have individualized learning plans for each student	✓
12	The pace of learning is common for all learners	✓
13	Factual knowledge and real life skills are not interlinked	✓
14	Information and Communication Technology is not an integral part of teaching and learning	✓
15	There are few educational opportunities that allow for alternative learning paths	✓
16	Assessment is not viewed as a learning tool, but merely as a scorecard	✓

(adapted from Kolderie and Mcdonald[1])

If the points above hold true for the way in which most schools operate, then it would be safe to agree with the following statement 2: **"... today we have schools from the 19th century, teachers from the 20th century and students from the 21st century"**. In other words, the physical and social limitations of a school still dictate where, when and what is to be learned, the technology used excludes present day reality in terms of needs and possibilities, and students are forbidden from actively participating in any step of the process. As a matter of fact, students are forced to adopt a totally alien life style when they walk though the school doors.

Introduction

This definition begs the following questions:

1. Is the school environment, and the time students spend in it, the only place and time in which learning should take place? What are the pedagogical principles on which this approach is based, especially the ones excluding the use of any present day technology?

2. Should the school, as an educational institution, be influenced by society and vice-versa? If so, what and how much flexibility should be provided so that the school fulfills this mission? How many and what resources - human and material - should be allocated to this objective?

3. Who has the responsibility to design and decide on the curriculum content? What are the needs of the stakeholders - personal, social or professional — which are served by the curriculum? How is the proportion between content knowledge and skills practice to be determined and assessed?

4. If present day technology is to be introduced in schools, does it imply knowledge of use of hardware and software or the facilitation of learning? Should technology affect the teaching environment only or the school operation in general? How can we bridge the digital divide that exists among teachers, pupils and parents? Which of the currently existing technologies and their associated uses will be "acceptable" in the school environment?

5. Furthermore, how familiar are the students and teachers involved with the use of technology? What is the process of creation, selection and integration of digital educational materials and who will be responsible for them? What needs are they to meet and how are they to be combined with technology? How do we assess achievement?

6. Finally, what is the desired degree of transparency in the school operation? What is the desired degree of stakeholder participation by and how will it be served? What kinds of partnerships should be encouraged and what are the proposed goals? What benefits should take priority from this approach?

In what follows we will try to address these questions, and more. Let it be clear from the very beginning however, that the discussion that follows is not driven by technology. The simple adoption and introduction of technological hardware and software cannot change the role of the school, the role of the teachers and the role of the students and make them effective for the educational needs of the 21st century. The purpose of this handbook is to investigate both the need for an emerging theoretical framework towards education and the use and exploitation of Information and Communication Technology, as well as the teaching implications and the practical considerations created by the digital reality.
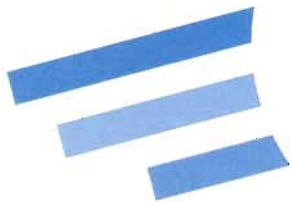
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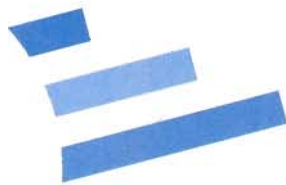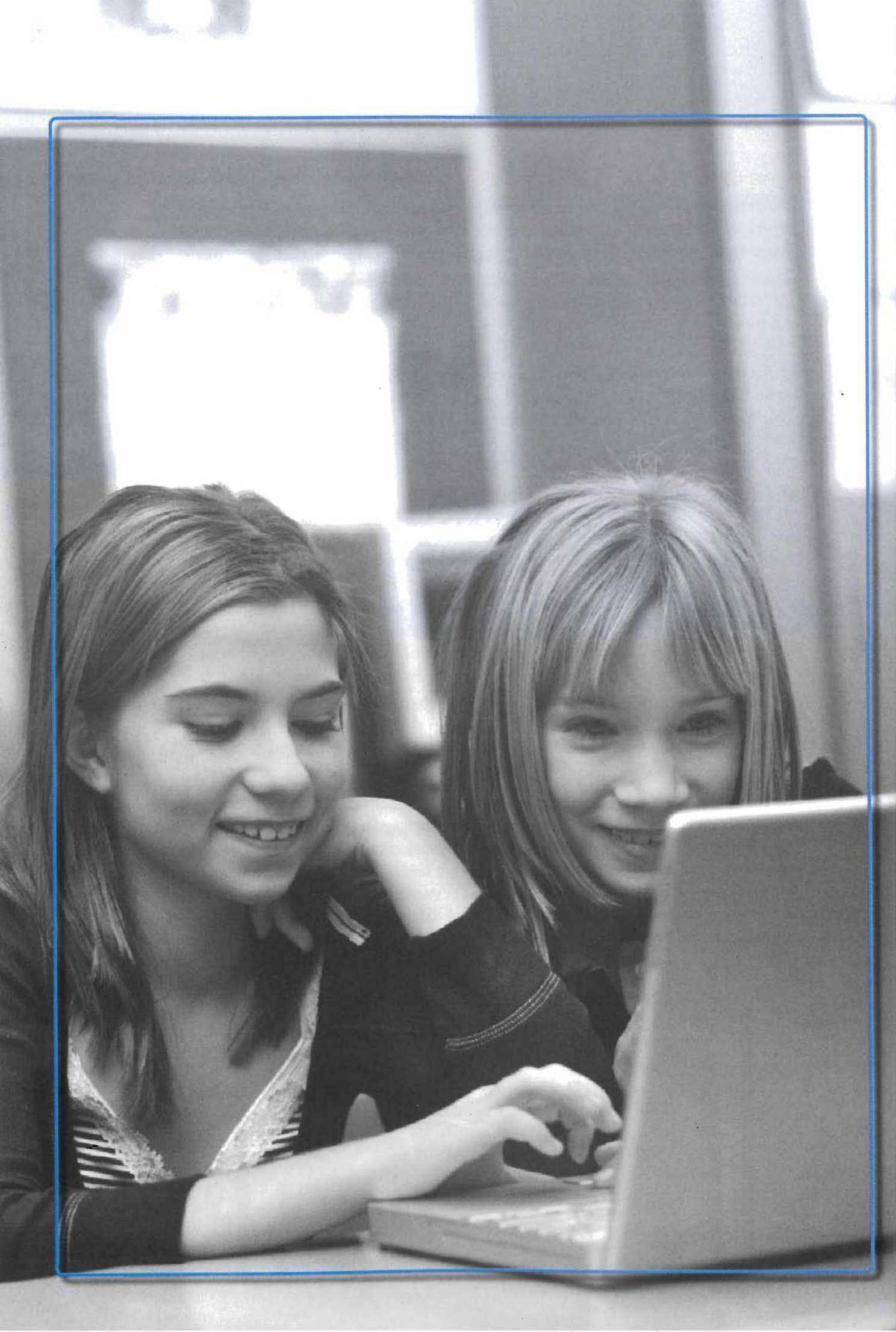
The pattern of progression to knowledge

Within the context of teaching practice three processes are commonly referred to: **Education** — **Learning** — **Training**[3]. We will attempt a (re-)definition of these terms to focus attention on the content that each one may take and how they may interact:

1. **Education**[3a]: the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally, of preparing oneself or others intellectually for mature life, the act or process of imparting or acquiring particular knowledge or skills, as for a profession, a degree, level, or kind of schooling: *a university education*, the result produced by instruction, training, or study: *to show one's education*, the science or art of teaching; pedagogics.

2. **Learning**[3b]: knowledge acquired by systematic study in any field of scholarly application, the act or process of acquiring knowledge or skill, the modification of behavior through practice, training, or experience.

3. **Training**[3c]: the process of bringing a person, etc., to an agreed standard of proficiency, etc., by practice and instruction: *training for the priesthood; physical training*.

In short, then,

*   **Education** refers to the general amount of Knowledge and number of Skills required for professional and social prosperity;
*   **Learning** refers to the systematic acquisition of specific Knowledge and Skills through study, practice, or experience; and
*   **Training** refers to the development of Knowledge and Skills through practice and instruction, which are relevant to specific standards.

A closer consideration of these processes will yield the following results:

*   There are implied differences in specificity and scope.
*   There are implied differences in importance and difficulty.
*   There is an implied hierarchy in how they are ordered.

These characteristics lead to three distinct patterns of progression: **Serial progression**, **Circular progression** and **Spiral progression**.

The pattern of progression to knowledge
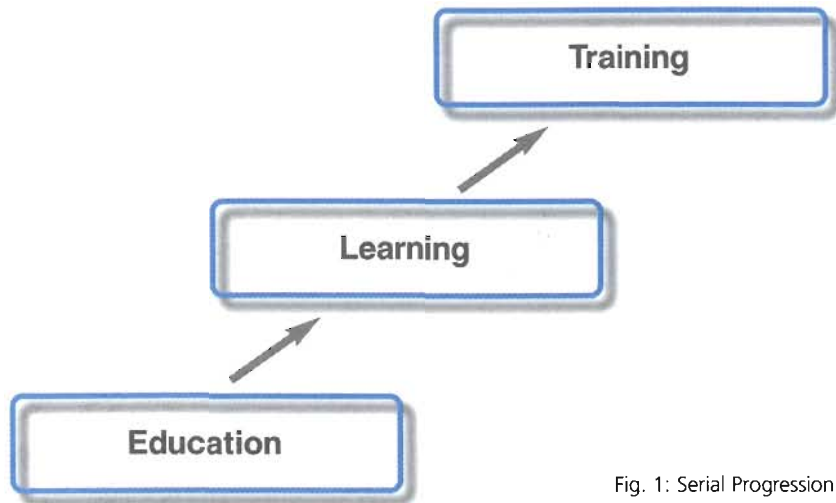
SERIAL PROGRESSION

Fig. 1: Serial Progression

A pattern of Serial Progression between processes, as in the figure above, means that the process placed at the lower end of the hierarchy is considered narrower and more specific, easier and more basic. In other words, we can call it **the starting point**. The process placed at the higher end of the hierarchy is considered broader and more general, more difficult and important. In other words, we can refer to it as **the goal**.

In a pattern of serial progression the entry level is much closer to the bottom of the hierarchy whereas the exit point is much closer to the top of the hierarchy. There is only one entry point, there is only one path to follow and there is only one exit point. Movement is unidirectional and any difficulty to reach the exit point is associated with failure.

Another feature of serial progression is the required degree of mastery of each of the steps on the path. It is assumed that lack of knowledge or skill at a lower level affects your ability to function at a higher level.

Finally, the most significant aspects of this approach are the assumptions we make for our students. Whatever level in the hierarchy we consider as the starting point, it is immediately assumed that our students have no or minimal mastery of the knowledge and skills which constitute the aim and focus of this level. If they had mastered the content, they would have moved to the next level. It is consequently the duty of the teacher to address all students in a uniform manner regardless of their individual needs and level of development. As a result, some students find the goals inappropriate, irrelevant or unsuitable. They become bored or disappointed.

This approach raises the following questions:

- Who defines the starting point?
- Who defines the goals?
- What is the desired degree of mastery at each level?
- What happens in the event of shortcomings or overlap?
- How are the needs of our students taken into consideration?
- How should we handle individual instances where differences exist?
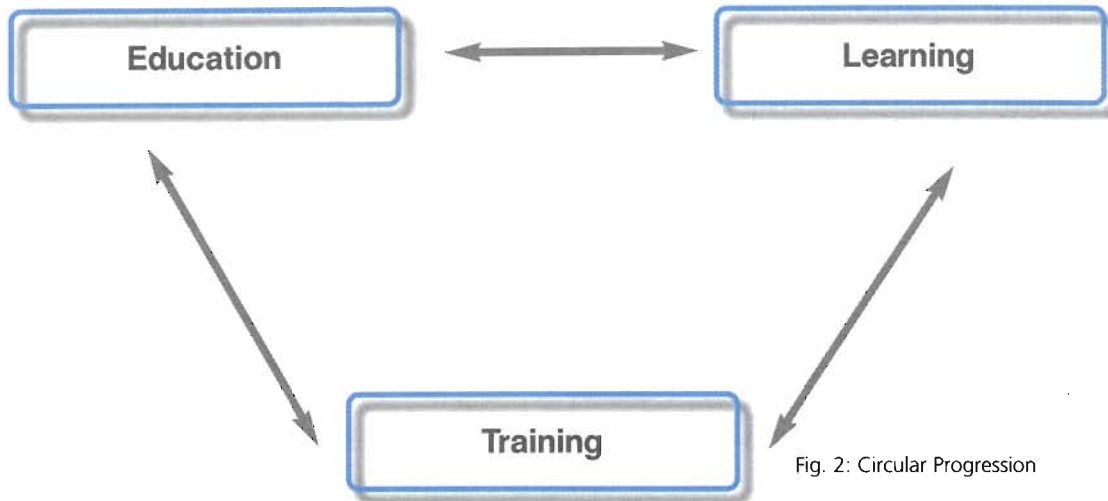
CIRCULAR PROGRESSION

Fig. 2: Circular Progression

A pattern of Circular Progression among these processes tries to answer the questions raised above. Each process has its own distinct identity with regard to specificity, scope, importance and difficulty. Each process plays its own role.

As shown in the figure above, any of the three processes can provide the desired starting point and/or goal, respectively. Consequently, there are many entry points and an equal number of exit points. Movement is bidirectional, which means that in case of difficulty there are alternative paths to follow. These paths allow for different steps, independent of the degree of mastery of the content of each process. As a result:

- Students can define their starting point and their goal.
- Students can map their own path according to their individual needs and profile based on their degree of mastery of the procedure they identify as the starting point.
- The degree of mastery of a process determines and defines the objectives for the next process. It is possible to review the degree of mastery of each level and, consequently, it is possible to revise the goal.
- Accordingly, the revised goal leads to a revised level of mastery of the previous level, since movement between the two is possible.
- The teacher as well as the student can design an individualised course to meet the specific needs and goals.
- Teachers cater for the needs of individual students, which in turn leads to greater motivation and involvement.

However, this approach lacks the characteristic of upward movement which is usually associated with success. Every time students go around the circle they run the risk of entering a path at a level of mastery close to the one they exited. Furthermore, every goal they set and conquer, is not necessarily linked to the goal they may want to set after that. A fourth dimension is required. This is best demonstrated by a pattern of Spiral Progression.
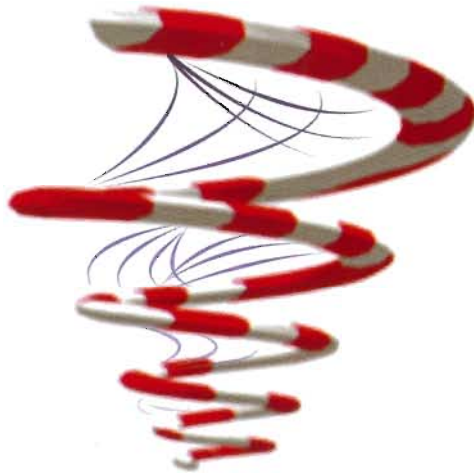
SPIRAL PROGRESSION

Fig. 3: Spiral Progression

A pattern of Spiral Progression between processes, as shown in the figure above, means that:

- The goals students set are all part of a bigger picture.
- They are interlinked in a continuous path towards professional and social prosperity.
- It is possible for different groups of students or individual students to be working on different goals at the same time.
- All of them share the same feeling of direction and purpose, while focusing on individual needs and requirements.
- Knowledge and Skills acquired within one context can be exported to another based on individual preferences.
- Knowledge and Skills can be shared by the members of the group.
- Students, and teachers, can adapt to changes faster and changes can be integrated rapidly in the teaching context.

This is, obviously, the theoretical approach of the European Reference Framework for Key Competences for Lifelong Learning[4]:

"As globalisation continues to confront the European Union with new challenges, each citizen will need a wide range of key competences to adapt flexibly to a rapidly changing and highly interconnected world. Education in its dual role, both social and economic, has a key role to play in ensuring that Europe's citizens acquire the key competences needed to enable them to adapt flexibly to such changes."

In short:

Learners need a pattern of progression among the three processes, **Education – Learning – Training**, that is flexible and adaptable to their own needs and requirements, a pattern that they will be able to follow for the duration of their professional and economic life and a pattern that will help them to respond to their personal and family needs, to the needs of their social and professional group. A pattern of **Spiral progression** seems to be the one to achieve these things.

Information and Communication Technologies

Continuing within the context of teaching practice, another term that has become increasingly common is that of Information and Communication Technologies, or ICT. Although the singular is often used — Technology, the plural form will be adopted to emphasise the fact that the means we have at our disposal to produce and to manipulate information as well as to transmit and disperse it, are neither unique nor uniform.

ICT cover any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form. The phrase was coined by Stevenson in his 1997 report to the UK government and promoted by the new National Curriculum documents for the UK in 2000[5a]. In their broader sense then, ICT include[5b]:

1. **Personal Computers:** These include any desktop or portable computer, i.e. laptops, netbooks, etc., regardless of its capabilities, software installed or peripherals: web camera, microphone, touch screen and stylus, connectivity to the Internet or mobile networks, etc.

2. **Interactive Whiteboards:** This refers to the digital board, which takes the place of the traditional whiteboard in the classroom and the infinite number of possibilities it offers.

3. **The Internet:** Cyberspace in general, offers multiple opportunities for communication, (re)search and exchange and creation of information.

4. **Electronic Games:** A learning and entertainment tool, available to everyone regardless of age, time or space.

5. **Social Networking Sites:** Specialized sites, for the exchange of information and communication, which also abolish spatial and temporal restrictions.

6. **Mobile Phones:** Originally, a communication device, which has already acquired many of the features and capabilities of computers.

7. **Digital Images:** Moving or still images, anything from videoclips to pictures, which may be the focus of an activity within the range of the software and hardware listed here.

8. **Digital Sound:** Music or speech files, which may be the focus of an activity within the range of the software and hardware listed here.

9. Furthermore, we do not want to exclude more traditional media such as **radio** or **television**, considering that users now have the opportunity to access them through the Internet. Again, messages transmitted through them are no longer restricted by space or time.

In addition to listing the various types of ICT, it is, also, important to consider the patterns and possibilities of interaction that they offer. For instance:

* A radio or television program can be transmitted through the Internet to the computer or the mobile phone of millions of users and through them to appear on the interactive whiteboards of thousands of schools.

* A picture or sound file may be the subject of a written or visual commentary of various social networking sites, or it may be the subject of research of a group of community members with the results sent to the original author or institution thousands of kilometers and numerous time-zones away.

* A text message, originating on a mobile phone or a computer, can form the script or concept of an electronic game, which in turn can be the starting point for a film, a musical event or an art product.