CHAPTER 2

Review of Literature on knowledge dissemination and learning:

There are three principal means of acquiring knowledge available to us: observation of nature, reflection, and experimentation. Observation collects facts; reflection combines them; experimentation verifies the result of that combination. Our observation of nature must be diligent, our reflection profound, and our experiments exact. We rarely see these three means combined; and for this reason, creative geniuses are not common. (Denis Diderot (1713–84), French philosopher. On the Interpretation of Nature, no. 15 (1753: repr. in Selected Writings, ed. by Lester G. Crocker, 1986).

2.1 National Curriculum Framework 2005

Perspectives:

India is a free nation with a rich variegated history, an extraordinarily complex cultural diversity and a commitment to democratic values and well being for all. If we look at what the system of education has accomplished since Independence, perhaps we have much to be satisfied with. Today, our country engages nearly 55 lakh teachers spread over around 10 lakh schools to educate about 2,025 lakh students. While 82 per cent of habitations have a

* National Council Framework 2005
primary school within a radius of one kilometre, there is an upper primary school within 3 kilometres for 75 per cent of habitations. At least 50 per cent of our students who appear at the school-leaving examinations pass out of the secondary school system. Despite these trends, 37 per cent people in India lack literacy skills, about 53 per cent students drop out at the elementary stage, and over 75 per cent of our rural schools are multi grade. Further, there is a deep disquiet about several aspects of our educational practice: (a) the school system is characterised by an inflexibility that makes it resistant to change; (b) learning has become an isolated activity, which does not encourage students to link knowledge with their lives in any organic or vital way; (c) schools promote a regime of thought that discourages creative thinking and insights; (d) what is presented and transmitted in the name of learning in schools bypasses vital dimensions of the human capacity to create new knowledge; (e) the “future” of the child has taken centre stage to the near exclusion of the child’s “present”, which is detrimental to the well-being of the child.

The review of the National Curriculum Framework, 2000 was initiated specifically to address the problem of curriculum load on students. A committee appointed by the Ministry of Human Resource Development in the early 1990s had analysed this problem, tracing its roots to the system’s tendency to treat information as knowledge. In its report, Learning Without Burden, the committee pointed out that learning at school cannot become a joyful experience unless we change our perception of the child as a receiver of knowledge and move beyond the convention of using textbooks as the basis for examination. The impulse to teach everything arises from lack of faith in student’s own creative instinct and their capacity to construct knowledge out of their experience. The size of textbooks has been growing over the years, even as the pressure to include new topics mounts and the effort to synthesise knowledge and treat it holistically gets weaker. Flabby textbooks, and the syllabi they cover,
symbolise a systemic failure to address students in a child-centred manner. Those who write such encyclopedic textbooks are guided by the popular belief that there has been an explosion of knowledge. Therefore, vast amounts of knowledge should be pushed down the throats of little students in order to catch up with other countries.

**Learning without burden** recommended a major change in the design of syllabi and textbooks, and also a change in the social ethos, which places stress on students to become aggressively competitive and exhibit precocity. To make teaching a means of harnessing the child’s creative nature, the report recommended a fundamental change in the matter of organising the school curriculum, and also in the system of examination, which forces students to memorise information and to reproduce it. Learning for the sake of being examined in a mechanical manner takes away the joy of being young, and de-links school knowledge from everyday experience.

We need to plan and pay attention to systemic matters that will enable us to implement many of the good ideas that have already been articulated in the past. Paramount among these are - connecting knowledge to life outside the school, ensuring that learning is shifted away from rote methods, enriching the curriculum to provide for overall development of students rather than remain textbook centric, making examinations more flexible and integrated into classroom life and nurturing an over-riding identity informed by caring concerns within the democratic policy of the country.
The aims of education:

The aims of education serve as broad guidelines to align educational processes to chosen ideals and accepted principles. The aims of education simultaneously reflect the current needs and aspirations of a society as well as its lasting values, and the immediate concerns of a community as well as broad human ideals. At any given time and place they can be called the contemporary and contextual articulations of broad and lasting human aspirations and values. Educational aims turn the different activities undertaken in schools and other educational institutions into a creative pattern and give them the distinctive character of being 'educational'. An educational aim helps the teacher connect his/her present classroom activity to a cherished future outcome without making it instrumental, and therefore give it direction without divorcing it from current concerns. Thus, an aim is a foreseen end: it is not an idle view of a mere spectator; rather, it influences the steps taken to reach the end.

An aim must provide foresight. It can do this in three ways: First, it involves careful observation of the given conditions to see what means are available for reaching the end, and to discover the hindrances in the way. This may require a careful study of students, and an understanding of what they are capable of learning at different ages. Second, this foresight suggests the proper order or sequence that would be effective. Third, it makes the choice of alternatives possible. Therefore, acting with an aim allows us to act intelligently. The school, the classroom, and related learning sites are spaces where the core of educational activity takes place. These must become spaces where learners have experiences that help them achieve the desired curricular objectives. An understanding of learners, educational aims, the nature of knowledge and the nature of the school as a social space can help us arrive at principles to guide classroom practices.
Knowledge and Understanding:

Knowledge can be conceived as experience organised through language into patterns of thought or structures of concepts, thus creating meaning, which in turn help us understand the world we live in. It suggests that in the curriculum, there must be as much focus on the process of learning on how learners engage with and reconstruct knowledge, as on the content of what is learnt. Knowledge can be categorised based on distinct kinds of concepts and meanings involved and processes of validation and justification. Each involves its own kind of ‘critical thinking’, its own way of verifying and authenticating knowledge, and its own kind of ‘creativity’. Layers of understanding include understanding the linguistic contents of what is said (comprehension); understanding what the terms and concepts refer to; understanding how to seek evidence and judge truth (Epistemic); understanding through developing interconnections between different facts and concepts and weaving them into an interconnected web of ‘known things’, understanding relationships between different things, and the significance of each in relation to the other (Relational and Significant).

2.2 National Level Survey in Schools by Educational Initiatives:

A national level research was jointly conducted by ‘Educational Initiatives’ and ‘Wipro - Applying Thought’ in schools to understand how well students are learning in the top schools of our country. Over 32,000 students and 142 leading schools of five metros participated in the survey. The findings present the shortcomings in our education system, which calls for immediate and serious reforms. As per the results of the survey, learning is rote based and does not focus on real knowledge. Students appear to be learning mechanically rather than

1 Wipro Applying Thought in Schools, What’s wrong with our teaching? Nov 27, 2006, India Today
truly understanding the concepts. The students slotted learning into artificial compartments and their ability to apply what they learnt to real life situations – essential for competence building – was not satisfactory.

"If we want to transform our destiny, we will have to change what we teach and how we teach." says Azim Premji, Chairman, Wipro. Schools need to refocus their priorities. Teachers need to move from teaching for exams to teaching for understanding. Classrooms need to become more experiential and collaborative so that every child learns deeply and meaningfully. The focus of schools has to change from simply preparing students for exams to helping them learn skills they will use in their lives. India's most popular schools have the resources to set a new benchmark in school culture, teacher competence and student learning. Their success will motivate other schools to rearticulate their aspirations and their processes. This could cascade and transform our educational system, which helps us realize our potential to transform our destiny.

We need to provide educational opportunities to all and enhance quality of education at all levels. Imaginative use of Information and Communication Technology (herein after referred to as ICT in the text) should help engage more learners in the excitement of learning and provide wider access to these more compelling learning experiences. Education institutions, Government and ICT industry should work as partners to create an environment where learning is more fun, more challenging and more productive. The mission and objectives of individuals, organizations and countries may vary but the common thread for all of them would be to enhance the learning capacity of individuals for life. The strategic framework outlined below is intended to help in formulation of strategy appropriate to the stakeholder's objectives and the context in which they are operating.
2.3 Data, information and knowledge:

Data are raw numbers with no meanings and which are not interrelated (Davenport, Prusak, 1998). Information is connected data with a particular meaning referred to the context in which they are used and reused (Laudon, Laudon, 1991). Knowledge is information enriched by experience and evolves every time someone’s intuition, perspective, information, mental models or experience change (Alavi, Leidner, 2001; Bourdreaux A., Couillard G. 1999). John Van Beveren, in his paper, ‘A model of knowledge acquisition that refocuses knowledge management’ expresses that - Information is acquired through the sensors to be processed in the brain, and new knowledge is created from the processing of information. With information, we make decisions for today and tomorrow, based on the world, as we know today. With knowledge and wisdom, we can acknowledge the need for, plan for and embark upon the idea of change.

Figure 2.1 depicts the model where information is acquired through the sensors and processed in the brain by using prior knowledge. Where knowledge is the stock of

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conceptual tools and categories used by humans to create, collect and share information (Laudon and Laudon, 1995, p. 15). During the processing of information, new knowledge can be acquired or created for future use, when more or new information is acquired and processed.

Figure 2.2 illustrates how knowledge is transformed into information within the brain to be communicated externally through language or demonstration. Language in this model includes all forms of communication, such as written, verbal and body language. In this model, the prior knowledge contained in human brains is required for the creation of information, just as the creation of knowledge often requires the input of information through the sensors to the brain. The initial formation of prior knowledge has been a huge area of debate for many years and has been discussed from two opposed positions, the empiricists and the nativists.

The empiricists maintain that we are born with the human mind as an empty vessel and that all knowledge is acquired through the sensors. A major proponent of this view was the English philosopher, John Locke. The nativists have an opposing view, that many aspects of our knowledge are based on innately given characteristics of the human mind. Plato was one of the first philosophers to take the position of the nativists' stance. More recently, Immanuel Kant argued for the nativists, that knowledge cannot come from sensory input alone and that

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there must be certain pre-existing "categories" according to which this sensory material is ordered and organized.

2.4 What is Knowledge?

Knowledge as – learning outcome / result

Six Levels of Knowledge:

1. Awareness – to recall, recognise, being aware of existence
2. Understanding – to translate from one form to another
3. Application – to apply or use information in a new situation
4. Analysis – to examine a situation and break it down into parts
5. Synthesis – to put together information in a new way
6. Evaluation – judge based on explicit criteria

(Adapted from Klatt (1999) and Krathwohl, Bloom and Masia -1964)¹

Knowledge is the ability to convert data and information into effective actions. Knowledge is a human ability, not the property of an object, as a book. Its transmission implies the intellectual processes of learning and teaching. Static knowledge has no value. Knowledge represents a real value only when it moves, through transmission or transformation. Knowledge generates more knowledge through reasoning or inference (by humans or by

¹ Janina Pasanuc, Cristian Seider, Daniela Bosioc and Camelia Nistor - Methods and Techniques used in Intercultural youth project, Life Foundation – Curz Voda 17, Oancea România
artifacts). Knowledge implies some degree of structure and elaboration, with rich semantic relations between entities. Knowledge is useful inside a particular context. Some underlying conventions or world model are required for an effective transmission. Knowledge can be explicit (then, it can be collected, managed and transferred easily) or tacit (the case of heuristic knowledge accumulated by experts in a particular field through experience). Knowledge can be formalized to different levels. At the lower level, informal knowledge is the kind of knowledge transferred through verbal communication. Knowledge is defined variously as (i) facts, information, and skills acquired by a person through experience or education; the theoretical or practical understanding of a subject, (ii) what is known in a particular field or in total; facts and information or (iii) awareness or familiarity gained by experience of a fact or situation. Knowledge acquisition involves complex cognitive processes: perception, learning, communication, association, and reasoning. The term knowledge is also used to mean the confident understanding of a subject, potentially with the ability to use it for a specific purpose. Defining knowledge accurately is difficult'.

Information, learning and knowledge:

Jennifer Rowley in her paper 'From Learning organization to knowledge entrepreneur' establishes a clear link between learning and knowledge and proposes a simple model, which makes this relationship explicit. Information is accepted into the organization from different sources. The organization or an individual conceptualizes that information in a way that is consistent with its norms, cognitive frameworks, context and cultures. This conceptualization

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process can be described as learning. Learning leads to knowledge, which may be either tacit (embedded in minds and activities) or explicit (stated as in verbal communications or in documents). Knowledge is available to support and inform decisions, behavior and actions. The final stage is the feedback from the actions, which in turn may generate further information, which form the basis for further learning. Intermediate feedback loops may also be evident between the individual stages in the process. It is important to create conditions for learning that leads effective knowledge creation and dissemination.

2.5 Knowledge Dimensions:

A number of researchers, such as Nonaka (1991)\(^1\), Nonaka and Takeuchi (1995)\(^2\), have used Polanyi's (1987)\(^3\) concept of explicit knowledge and tacit knowledge in defining knowledge dimensions. Explicit knowledge is easy to articulate, capture, and distribute in different formats, whereas tacit knowledge is difficult to capture, codify, adopt, and distribute, because individuals cannot easily articulate this type of knowledge.

Leonard and Sensiper describe knowledge as a continuum\(^4\):

"Knowledge exists on a spectrum. At one extreme, it is almost completely tacit, that is semiconscious and unconscious knowledge held in peoples' heads and bodies. At the other end of the spectrum, knowledge is almost completely explicit or codified, structured and accessible to people other than the individuals originating it. Most knowledge of course exists

between the extremes. Explicit elements are objective, rational and created in the 'then and there', while the tacit elements are subjective, experiential and created in the 'here and now' (Leonard & Sensiper, 1998: 113).

For Nonaka (1991) tacit and explicit knowledge are not separate but mutually complementary entities. They interact with each other in the creative activities of human beings. Nonaka calls the interaction of these two forms of knowledge "the knowledge conversion process". This conversion process consists of four stages: socialization, externalization, combination and internalisation. The first step, socialization, transfers tacit knowledge between individuals through observation, imitation and practice. In the next step, externalization is triggered by dialogue or collective reflection and relies on analogy or metaphor to translate tacit knowledge into documents and procedures. Combination consequently reconfigures bodies of explicit knowledge through sorting, adding, combining and categorising processes and spreads it throughout an organisation. Lastly, internalization translates explicit knowledge into individual tacit knowledge. Eventually, through a phenomenon that Nonaka calls the "knowledge spiral", knowledge creation and sharing become part of the culture of an organisation.

There is a shift from simply capturing and leveraging knowledge to supporting learning and the sharing of knowledge. If we accept that learning comes about through experience and interaction with our milieu, then it is not difficult to accept that learning will involve both explicit and tacit knowledge. However, it is important at this point to re-emphasize the key attribute of knowledge: that it exists in people's heads. Once explicit knowledge has been committed to

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paper, (or any other medium) it becomes information. The original knowledge remains in the mind of the author and (in an ideal world) is only transmitted to the mind of the reader through this medium. Notwithstanding this, we would argue that role of technology in knowledge management is to make the implicit visible. The ability to bring to the surface implicit assumptions and the role that this can play in developing a shared understanding around a particular issue is perhaps one of the best means of building an appreciation of what is tacit without going through the effort of attempting to make it explicit.

2.6 Knowledge codification:

Distinctions can be made between different kinds of knowledge, which are important in the knowledge-based economy: know-what, know-why and know-how.

Know-what refers to knowledge about “facts”. Here, knowledge is close to what is normally called information – it can be broken down into bits. In some complex areas, experts must have a lot of this kind of knowledge in order to fulfill their jobs. Practitioners of law and medicine belong to this category.

Know-why refers to scientific knowledge of the principles and laws of nature. This kind of knowledge underlies technological development and product and process advances in most industries. The production and reproduction of know-why is often organised in specialized organisations, such as research laboratories and universities.

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1 The Knowledge-Based Economy, Organisation for Economic Co-Operation And Development (OECD), General Distribution, OCDE/GD(96)102, Paris 1996.
Know-how refers to skills or the capability to do something. Know-how is typically a kind of knowledge developed and kept within the borders of an individual firm. One of the most important reasons for the formation of industrial networks is the need for firms to be able to share and combine elements of know-how.

Learning to master the different kinds of knowledge takes place through different channels. While know-what and know-why can be obtained through reading books, attending lectures and accessing databases, know-how is rooted primarily in practical experience. Know-how will typically be learned in situations where an apprentice follows a master and relies upon him as the authority.

2.7 Teachers’ views of knowledge:

Vivienne Collinson and Tanya Fedoruk Cook, in their paper 'Learning to share, sharing to learn, Fostering organizational learning through teachers' dissemination of knowledge', expressed that ‘Teachers generally view knowledge as something gained through individual experience’. Teachers have few mechanisms for adding to the knowledge base in teaching and leave no legacy of insights, methods and materials at the close of a long career’ (Little, 1987, p. 502). Simply put, “the ablest [teachers] are not expected to add to the shared knowledge of the group. Instead of engaging in a coherent search for knowledge based on a tradition of best practices, teachers continue to extend their teaching repertoires with a potpourri of ideas culled from any available sources. This “practicality ethic” (Doyle and

Ponder, 1977-78, p. 2); means that changes “which are seen as practical will be incorporated, at least tentatively, into teacher plans”.

Students’ success or progress, in turn, acts as an “informal indicator of [the teacher’s] success” and contributes to a “sense of usefulness” (Jackson, 1990, p. 134). “The teacher is the judge of what works” (Jackson, *ibid.*, p. 78). As one of Jackson’s (*ibid.*, p. 131) teachers explained, “I think that it is important that a teacher is respected for her own ideas about teaching and is not told how to do it”.

Although the school is frequently considered as the unit of change, the success or failure of initiatives in schools depend on individual teachers – their interest in the innovation, their perception of benefits to students, their willingness to learn, and their opportunities to share their learning. As more is understood about the conditions that influence the dissemination of new knowledge, skills, and insights among teachers and schools, educators will be better able to effect organizational change through investment in and differentiation of teachers’ individual and collaborative learning. As teachers learn to learn from one another and interact around substantive issues of teaching and learning and their own professional growth, their joint insights may shift the emphasis from individual classroom innovations to contributions to the teaching profession, resulting in organizational learning and change for the benefit of students.

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2.8 Characteristics of knowledge acquisition and dissemination

Information, data and facts and the process of their collection are essential to the cognitive process and to knowledge acquisition as a whole. However, mere information is only the first step in the acquisition of knowledge for the learner. And its dissemination is similarly only a first step in knowledge dissemination. Information can be said to relate more to data and meaning, whereas knowledge must imply an acquaintance with this data and meaning through deeper study and investigation. The most relevant aspect for learning and knowledge acquisition is the “internalization” of information, that is to say that knowledge is born from information that must “engage” the learner, his or her faculties and character. Unlike data and facts, knowledge is not something that can be simply collected, memorized and regurgitated (for instance through technical agents like search engines).

It must be noted that the same kind of information (and knowledge) can be embedded or encoded in many different forms. The “indivisibility” of knowledge (and in this respect its limited transferability) is due to its immateriality. Knowledge (non-trivial knowledge that is) is always a complex assembly of relevant elements that all relate to one another. The diversity of knowledge further facilitates the innovative process by enabling the individual to make novel associations and linkages between these elements.

Knowledge it is said, begets knowledge. Or if you prefer, we create resources by using the ones that we already have, in a process that involves furthering human development.

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Lara Srivatsava, Dissemination and Acquisition of Knowledge in the Mobile Age, Conference organized by the Institute for Philosophical Research of the Hungarian Academy of Sciences & Mobile Hungary, Budapest, 28-30 April 2005
(technological, scientific and social). It is easier to build on related knowledge that has already been acquired, than to acquire purely “fresh” knowledge. In other words, learning is a cumulative process and learning performance is greatest when the object of learning is related to what is already known.

We are aware that the acquisition of knowledge is a dynamic and evolutionary process, and can never be the same twice. Even though technologies such as search engines may be leading to uniform media for the dissemination of information, there will continue to be a non-uniform interpretation of that information. Acquisition of knowledge will always be characterized by cognitive path dependencies (a concept expounded by Nelson and Winter).

In sum, the points just outlined shed light on the same complex issue, only from different angles – the issue that we have a growing stockpile of networked information and knowledge (in whatever shape it might be) which can be interpreted differently by learners (individual and institutional), depending on their different backgrounds (wealth, accessibility, talent, cultures, education) and that this networked knowledge is richer for its diversity and individuality.

2.9 Opportunities for enhanced knowledge dissemination:

The first is the opportunity to increase our collective fund of knowledge. It is a common understanding that learners of today have an instant and much wider access to information, through the use of new information and communication technologies. The increase in the
collective fund of information, through content and information aggregators, results in the collective growth of knowledge, in turn translating into societal progress, and into greater individual and community knowledge acquisition. In addition, access to information, as a stepping-stone to knowledge, has now been extended to a greater proportion of the world's population. Moreover, information has become indexed, interactively searchable and accessible from any location. In this context, the power of knowledge to beget knowledge is also enhanced - the growth of information on global networks (accessed by learners) leads to the exploitation within the community of users of knowledge that might otherwise remain unexploited (e.g. talents or previous knowledge that are incomplete). The more information and knowledge are available through global networks, the more varied are the paths and opportunities for knowledge creation.

The potential for cross-cultural knowledge exchange, knowledge transfer, and cross-fertilization of ideas is greatly improved through global networks and wider access. Diversity relates not only to the types of knowledge, but also to the shape in which knowledge is "encoded", or the shape in which it is accessible – for example, one can think of the many kinds of multimedia and interactive tools available today and in the future. This will once again increase the potential reach of knowledge. Such tools, combined with always-on access, enhance the potential utility of complementary or supporting information and knowledge.

Another important opportunity is the "multi-dimensional space" afforded by the digital age. Global Networks create fluid multi-faceted spaces for learning, which can re-enforce and further enhance knowledge dissemination, through the exploitation of the user/producer relationship with text and meaning. A key implication of this multi-dimensional space is that it
creates an enriched platform for discourse — an important element of knowledge dissemination. The phenomenon of discussion groups, for instance — forms a space where ideas are constantly blending and even clashing, thereby leading to greater opportunities for knowledge acquisition. In this respect, mobile and Internet infrastructures act as a catalyst for the flow and development of knowledge. Multi-dimensional educational space will have a significant and positive impact on personalized and customized knowledge acquisition through the use of new technologies. Every knowledge acquisition process is individual and specific. Learners are bounded by their own contexts, experience and history, in terms of how they acquire knowledge or solve a problem. These processes are social and institutional rather than purely individual, involving socially formed signs, meanings and habits of thought.

2.10 Knowledge dissemination in the digital age:

Drucker (1995) tells us we are entering the knowledge society in which the basic economic resource will be knowledge. The term “knowledge-based economy” results from a fuller recognition of the role of knowledge and technology in economic growth. Knowledge, as embodied in human beings (as “human capital”) and in technology, has always been central to economic development. The development of information technology may be regarded as a response to the need for handling know-what and know-why portions of knowledge more effectively. Conversely, the existence of information technology and communications infrastructures gives a strong impetus to the process of codifying certain types of knowledge. All knowledge, which can be codified and reduced to information, can now be transmitted

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over long distances with very limited costs. It is the increasing codification of some elements of knowledge, which have led the current era to be characterised as “the information society” – a society where a majority of workers will soon be producing, handling and distributing information or codified knowledge.

The knowledge-based economy places great importance on the diffusion and use of information and knowledge as well as its creation*. The determinants of success of enterprises, and of national economies as a whole, is ever more reliant upon their effectiveness in gathering and utilizing knowledge. Strategic know-how and competence are being developed interactively and shared within sub-groups and networks, where know-who is significant. The economy becomes a hierarchy of networks, driven by the acceleration in the rate of change and the rate of learning. What is created is a network society, where the opportunity and capability to get access to and join knowledge and learning intensive relations determines the socio-economic position of individuals and firms (David and Foray, 1995)†.

The digital revolution has intensified the move towards knowledge codification and altered the share of codified vs. tacit knowledge in the knowledge stock of the economy. Electronic networks now connect a vast array of public and private information sources, including digitised reference volumes, books, scientific journals, libraries of working papers, images, video clips, sound and voice recordings, graphical displays as well as electronic mail. These

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information resources, connected through various communications networks, represent the components of an emerging, universally accessible digital library.

While information technologies may be moving the border between tacit and codified knowledge, they are also increasing the importance of acquiring a range of skills or types of knowledge. The knowledge-based economy is characterised by the need for continuous learning of both codified information and the competencies to use this information.

As access to information becomes easier and less expensive, the skills and competencies relating the selection and efficient use of information become more crucial. Codified knowledge might be considered as the material to be transformed, and tacit knowledge, particularly know-how, as the tool for handling this material. Capabilities for selecting relevant and disregarding irrelevant information, recognising patterns in information, interpreting and decoding information as well as learning new and forgetting old skills are in increasing demand.

The accumulation of tacit knowledge needed to derive maximum benefit from knowledge codified through information technologies can only be done through learning. Education will be the centre of the knowledge-based economy, and learning the tool of individual and organisational advancement. This process of learning is more than just acquiring formal education. In the knowledge-based economy “learning-by-doing” is paramount. A fundamental aspect of learning is the transformation of tacit into codified knowledge and the movement, back to practice where new kinds of tacit knowledge are developed. Training and learning in non-formal settings are increasingly possible due to information technologies.
which are more common. Networks, where interactive learning involving learners in experimentation and exchange of information is the driver of innovation (EIMS, 1994). 

Review of learning concepts and theories:

2.11 What is Learning?

Learning, as the noun, is the body of knowledge (that which one learns); as the verb, it is the process of gaining understanding that leads to the modification of attitudes and behaviors through the acquisition of knowledge, skills and values, through study and experience. Learning induces a persistent, measurable, and specified behavioral change in the learner to formulate a new mental construct or revise a prior mental construct. The learning process leads to long-term changes in behavior potential. Behavior potential describes an individual's possible behavior in a given situation to achieve a goal.

Education can be defined as the conscious attempt to promote learning in others. Traditionally, analysis of this attempt has centered around direct teaching on the part of teachers. In what constitutes a paradigm shift, however, people now note that learning can be promoted in ways that go beyond direct instruction by a teacher. Education now centers around creating a viable, productive learning environment, regardless of how teacher-centric that environment might be. E-learning is more specifically related to "electronic learning". Many distance education programs use electronic teaching methodologies (courseware) to facilitate the educational process. These programs will often talk about doing "e-learning."

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2.12 Learning Concepts

According to Smith, it is possible that learning defies precise definition because it is used to describe either a product, a process or a function. When learning is used to describe a product, the emphasis is on the outcome of the experience. When it is used to describe a process, an attempt is made to account for what happens when a learning experience takes place.

2.12.1 Learning as a product

According to Gagne and Medsker (1996), "Learning is relatively permanent change in human capabilities that is not a result of growth processes". Learning is approached as an outcome - the end product of some process. This approach has the virtue of highlighting a crucial aspect of learning - change. The depth or nature of the changes involved is likely to be different.

This theory stipulates that there are several different types or levels of learning. The significance of these classifications is that each different type requires different types of instruction. Gagne suggests that learning tasks for intellectual skills can be organized in a hierarchy according to complexity: stimulus recognition, response generation, procedure following, use of terminology, discriminations, concept formation, rule application and problem solving.

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1 Janina Pasanuc, Cristian Serete, Daniela Bosic and Camelia Nistor, Methods and Techniques used in Intercultural youth project, Life Foundation – Cuza Voda 17 Oradea Romania

Different instruction is required for different learning outcomes. Events of learning operate on the learner in ways that constitute the conditions of learning. The specific operations that constitute instructional events are different for each different type of learning outcome. Learning hierarchies define what intellectual skills are to be learned and a sequence of instruction. The primary significance of the hierarchy is to identify prerequisites that should be completed to facilitate learning at each level. Prerequisites are identified by doing a task analysis of a learning / training task. Learning hierarchies provide a basis for the sequencing of instruction.

2.12.2 Learning as a process:

Four primary processes involved in learning are:

- wanting to learn (motivation, thirst for knowledge);
- learning by doing (practice, trial and error, getting one’s hands dirty);
- learning from feedback (other people’s comments, seeing the results);
- digesting (making sense of what has been learned, getting a grip on it).

Phil Race (1994) in his book ‘The Open Learning Handbook’ - asking people further questions about where and when they learn reveals that most people consider they learn best as follows:

- at their own pace;
- at times and places of their own choosing;
- often with other people around, especially fellow-learners.

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1 Janina Pasaniciu, Cristian Snieder, Daniela Bosioc and Camelia Nistor, Methods and Techniques used in Intercultural youth project.
when they feel in control of their learning.

2.13 Learning theories

In education, learning theories are attempts to describe how people learn, thereby helping us understand the inherently complex process of learning. Behaviourism was the predominant school of thought in learning theory in the 1950s and 1960s. This theory defines learning as the changes that take place in the observable behaviour of a learner in terms of stimulus-response processes. Behaviourists were not interested in internal mental states, but concentrated their attention on what was observable and therefore external. The behavioral approach to motivation suggests that it is the teacher's responsibility to manipulate the environment in order to motivate students and sustain their motivation. Even though behaviourism has limitations in developing a learner centric environment, it is considered useful for alignment of learning objectives, instructional strategies and methods used to assess learning outcomes. This brief survey of learning theories demonstrates the shift in emphasis in learning from a passive state where learning is broken down into discrete bits to be absorbed by the student to an active process where the student is personally involved in developing his own understanding of real-world issues.

2.13.1 The Cognitivism:

Cognitivism countered the behaviourist perspective with a view of knowledge acquisition as a symbolic, mental construction in the mind of individuals and as the outcome of learning. Thus, they see learners understanding new relations among the parts of a problem by acquiring and reorganizing information into understandable cognitive structures or 'schema'.
This approach provided a basis for analyzing concepts and procedures of subject matter curricula in terms of information structures, and gave rise to new approaches to pedagogy. Within this broad perspective, particular sub-areas of cognitive research can be highlighted as particularly influential, e.g.: schema theory, information processing theories of problem solving and reasoning, levels of processing in memory, general competencies for thinking, mental models and meta cognitive processes. The underlying theme for learning is to model the processes of interpreting and constructing meaning, and a particular emphasis was placed on the instantiation of models of knowledge acquisition in the form of computer programs (e.g.: Newell, 1990). Knowledge acquisition was viewed as the outcome of an interaction between new experiences and the structures for understanding that have already been created. So building a framework for understanding becomes the learner's key cognitive challenge. This kind of thinking stood in sharp contrast to the model of learning as the strengthening of associations.

The cognitive account saw knowledge acquisition as proceeding from a declarative form to a procedural, compiled form. As performance becomes more expert-like and fluent, the component skills become automated. Thus, conscious attention is no longer required to monitor the low-level aspects of performance and cognitive resources are available for more strategic levels of processing.

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1 Terry Mayes & Sara de Freitas, JISC e-Learning Models Desk Study Stage 2 Review of e-learning theories, frameworks and models, issue 1, pp. 1-43
2.13.2 Cognitive Load Theory:

John Sweller et al., in their article 'Cognitive Architecture and Instructional Design' stated that cognitive load theory has been designed to provide guidelines intended to assist in the presentation of information in a manner that encourages learner activities that optimize intellectual performance. The theory assumes a limited capacity working memory that includes partially independent subcomponents to deal with auditory/verbal material and visual/2- or 3-dimensional information as well as an effectively unlimited long-term memory, holding schemas that vary in their degree of automation. These structures and functions of human cognitive architecture have been used to design a variety of novel instructional procedures based on the assumption that working memory load should be reduced and schema construction encouraged. This paper reviews the theory and the instructional designs generated by it.

Information may only be stored in long-term memory after first being attended to, and processed by, working memory. Working memory, however, is extremely limited in both capacity and duration. These limitations will, under some conditions, impede learning. A modal model of memory distinguishes between three distinct memory types (modes). These are sensory memory, working memory and long-term memory. Each mode has its own characteristics and limitations. These three modes are integrated to define information processing model of human cognitive architecture.

The process of learning requires working memory to be actively engaged in the comprehension (and processing) of instructional material to encode to-be-learned information into long-term memory. Cognitive load theory states that learning will be maximised by ensuring that as much of a learner's working memory as possible is free to attend solely to encoding to-be-learned information. Reducing total cognitive load imposed by a body of to-be-learned information increases the portion of working memory, which is available to attend to the learning process. This may only be achieved by engineering reduced levels of extraneous cognitive load through instructional design. Content areas that are most likely to demonstrate beneficial results from improved instructional design are those that deal with "complex" information where the elements of to-be-learned information interact with one another (therefore imposing a high level of intrinsic cognitive load). According to cognitive load theory, we need to reduce total cognitive load, and maximise cognitive resources available to be utilised in the learning process.

Schemas and automation appear to explain expert / novice differences. Experts, because of their expansive set of schemas, have effectively seen almost every possible situation in the content domain before. Moreover, they have learnt what response is required for each situation and can carry out the required responses automatically, without the need for high levels of concentration. Novices, on the other hand, have relatively few schemas. They have trouble recognising anything but the most basic and common situations as ones that they have encountered previously. Schemas not only provide the ability to combine 'many elements' into a single element. They also have the capacity to incorporate the interactions between elements. This means that information, which consists of several elements, all of which interact with one another, may be embodied into a single schema. For example, a professional fibre glasser holds a schema for 'mixing resin' which takes into account not only
the ideal ratio of resin and catalyst that need to be mixed, but also, automatically, considers interacting factors such as the air temperature, air moisture, and purpose of the mixture. It is likely that a novice in this area would not even know that if environmental factors such as temperature and moisture are not taken into account, then a defective mixture may result. Learning with understanding implies increase in germane cognitive load by way of schemas stored in the long-term memory resulting in knowledge acquisition.

How cognitive load theory impacts Learning Environment:

Cognitive load theory provides instructional designing principles for structuring information, which facilitates building knowledge in long-term memory. Cognitive Load Theory suggests increase in germane cognitive load, which shall encourage schema construction and schema automation for the concepts that are consistent and relevant across varying problem situations. The ability to identify similar and relevant features in varying situations yields better schema construction and enhances problem solving skills and knowledge transfer. Interactive components like applets help the student to actively interact and involve in the process of understanding which stimulates schema construction of concepts and there by increase germane cognitive load. However the learning outcomes of these visual simulations depends on the level of expertise of learners.

Modifying the instructional materials to engineer a lower level of extraneous cognitive load will facilitate learning if the resulting total cognitive load falls to a level that is within the bounds of mental resources. Content is disassembled into component parts and organized into a conceptual framework which when effectively presented to the learner, is assumed to result in an understanding of the desired learning. Sequencing Content is putting the content
together in some sort of order, which enables the learner to achieve the learning objectives. There are a number of approaches, which can be taken when sequencing content. Prerequisite Sequencing is a method suggested by Gagné, (1985) which requires content to be presented so that requisite skills are given first and built upon as subsequent material is presented. Content design and sequencing that graduates from simple to increased levels of complexity may alter intrinsic cognitive load and reduce extraneous cognitive load.

Cognitive load theory helps learners understand and remember complex subjects by breaking down the information into logical chunks. Based upon Princeton psychology professor George A. Miller's classic article entitled 'The Magical Number Seven, Plus or Minus Two', Cognitive load theory describes learning structures in terms of an information processing system involving long term memory and working memory. Information may only be stored in long term memory after first being attended to and processed by working memory. Working memory is extremely limited in capacity and duration and is only able to handle 7 + or - 2 chunks of information. Split attention effect, Modality effect, Redundancy effect, Worked example effect are some of the instructional techniques followed to reduce cognitive load. However the techniques generated from cognitive load theory should be viewed as "rules of thumb" rather than absolute "laws of instruction".

The instructional designs that flow from cognitive load theory are required for high but not low element interactivity material. As expertise increases, material that is essential for novices may become redundant and so impose an extraneous cognitive load compared to

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2 George A. Miller, The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information, Psychological Review. American Psychological Association Vol 101 No 2 343-352.
instruction that does not include the material, resulting in the expertise reversal effect (Kalyuga, Ayres, Chandler and Sweller 2003). The guidance fading effect is a logical amalgam of the worked example, completion and expertise reversal effects. It assumes that as levels of expertise increase, the full worked examples associated with the worked example effect can decrease to be replaced by the partial worked examples associated with the completion effect. These completion problems, in turn, can be replaced by full problems once sufficient knowledge has been accumulated and hence the instruction design should be flexible to be relevant to the context and the learner profile.

Limitations:

1. Cognitivism tends to prioritize structure over process and statics over dynamics. As a consequence there has been less attention paid to how individual schemata are formed, reproduced, modified, or overturned over time, or how malleable they are depending on the alternative contexts and social settings within which they are drawn upon and performed (c.f. Goffman, 1959).

2. Difficult to apply in extended audience (it requires user oriented approaches) due to the required resources and effort.

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2.13.3 Constructivism:

In school level educational research the influence of Piaget has been significant, in particular his assumption that conceptual development occurs through intellectual activity rather than by the absorption of information¹. Brown et al (1989)² argued that we should consider concepts as tools, to be understood through use, rather than as self-contained entities to be delivered through instruction. This is the essence of the constructivist approach in which the learners' search for meaning through activity is central.

Constructivism proposes that knowledge is derived by each individual through their personal interaction with their environment within the world. Constructivists, expanding on "Piagetian learning", suggest that children create intellectual structures, which give order to their world by interacting with it and developing their own understandings and knowledge from their interactions. Constructivism views learning as a process in which the learner actively constructs or builds new ideas or concepts based upon current and past knowledge. In other words, "learning involves constructing one's own knowledge from one's own experiences. Constructivist learning, therefore, is a very personal endeavor, whereby internalized concepts, rules, and general principles may consequently be applied in a practical real-world context.

The teacher acts as a facilitator who encourages students to discover principles for themselves and to construct knowledge by working to solve realistic problems. Teachers can

¹ Terry Mayes & Sara de Freitas JISC e-Learning Models Desk Study: Guide 2: Review of e-learning theories frameworks and models issue 1 pp 1-43
help students to organise their ideas and elaborate on what they learnt. Constructivism promotes a student's free exploration within a given framework or structure.

2.13.4 The Assumptions of Constructivism:

A constructivist believes that knowledge is built up or constructed from within as we have experiences in our lives and that children create knowledge not just by doing but by reflecting upon and discussing what they have done. Learning is an active process in which meaning is developed on the basis of experience and conceptual growth comes from the negotiation of meaning, the sharing of multiple perspectives and the changing of our internal representations through collaborative learning. A constructivist generally views learning as a social process, in which students compare and contrast their ideas about the patterns they see and what they believe about particular problems or concepts. Learning is considered as personal interpretation of the world and hence should be situated in realistic settings and testing should be integrated with the task instead of being a separate activity. Multiple perspectives, authentic activities and real-world environments are just some of the themes that are frequently associated with constructivist learning and teaching. There are many similarities between the perspectives of different researchers in this brief review of the literature.

1. Multiple perspectives and representations of concepts and content are presented and encouraged while teachers serve in the role of guides, monitors, coaches, tutors and facilitators.
2. Goals and objectives are derived by the student or in negotiation with the teacher or system and the student plays a central role in mediating and controlling learning. Collaborative and cooperative learning are favored in order to expose the learner to alternative viewpoints. Scaffolding is facilitated to help students perform just beyond the limits of their ability.

3. Activities, opportunities, tools and environments are provided to encourage metacognition, self-analysis, regulation, reflection & awareness. Exploration is a favoured approach in order to encourage students to seek knowledge independently and to manage the pursuit of their goals. Problem-solving, higher-order thinking skills and deep understanding are emphasized.

4. Learning situations, environments, skills, content and tasks are relevant, realistic, authentic and represent the natural complexities of the 'real world' and primary sources of data are used in order to ensure authenticity and real-world complexity. Learners are provided with the opportunity for apprenticeship learning in which there is an increasing complexity of tasks, skills and knowledge acquisition. Assessment is authentic and interwoven with teaching.

5. Knowledge construction and not reproduction is emphasized. This construction takes place in individual contexts and through social negotiation, collaboration and experience. The learner's previous knowledge constructions, beliefs and attitudes are considered in the knowledge construction process. Errors provide the opportunity for insight into students' previous knowledge constructions. Knowledge complexity is reflected in an emphasis on conceptual interrelatedness and interdisciplinary learning.
Honebein (1996) describes seven goals for the design of constructivist learning environments:

- provide experience of the knowledge construction process
- provide experiences in and appreciation of multiple perspectives
- embed learning in realistic and relevant contexts
- encourage ownership and voice in the learning process
- embed learning in social experience
- encourage the use of multiple modes of representation
- encourage self-awareness of the knowledge construction process.

How Constructivism Impacts Learning environment:

**Curriculum** - Constructivism calls for the elimination of a standardized curriculum. Instead, it promotes using curricula customized to the participants' prior knowledge. The curriculum should give importance to conceptual interrelatedness by providing multiple representations or perspectives on the content. The emphasis should be on hands-on problem solving with focus on realistic approaches to solve real-world problems.

**Instruction** - Under the theory of constructivism, trainers focus on making connections between facts and fostering new understanding in participants. Trainers tailor their training strategies to participant responses and encourage participants to analyze, interpret, and
predict information. Teachers also rely heavily on open-ended questions and promote extensive dialogue among participants. Teachers focus on context dependent, collaborative knowledge construction by providing real-world, case-based learning environments with multiple representations of reality.

Assessment - Constructivism calls for the elimination of grades and standardized testing. Instead, assessment becomes part of the learning process so that participants play a larger role in judging their own progress in a rich, authentic problem-solving environment.

Limitations:

- Assessment of learner's grasp of material is very difficult.
- Needs a very good infrastructure with many information sources/references e.g. books, software programs, internet access, laboratories (very expensive).
- Learner must have a level of maturity (If learner does not take responsibility for learning/ have weak self management skills. system fails).
- Human resource intensive.
- Difficult to develop problems that will motivate all learners to participate in learning process.
2.13.5 Brain-Based Learning:

Neuroscience is the study of the human nervous system, the brain, and the biological basis of consciousness, perception, memory, and learning. The brain is better described as a self-organizing system. The brain changes with use, throughout our lifetime. Mental concentration and effort alters the physical structure of the brain. As we use the brain, we strengthen certain patterns of connection, making each connection easier to create next time. This is how memory develops. When trainers take neuroscience into account, they organize a curriculum around real experiences and integrated, "whole" ideas.

Brain based learning theory suggests that each brain is unique and the search for meaning comes through patterning. We understand best when facts are embedded in natural and spatial memory. Theory of Multiple Intelligence identifies that there are many forms of intelligence and that people have varying strengths and combinations of these. Gardner has currently outlined at least seven forms of intelligence. We learn, we communicate and we solve problems in at least seven ways. Intelligence is the ability to see a problem, then solve a problem or make something that is useful to a group of people. This theory is an ideal framework to use in ensuring good teaching practices and improved outcomes (results) for students. While the intelligences are discrete in terms of their existence in the brain, "real world" activities inevitably involve a blend of intelligences. Multiple Intelligences provides the framework for being able to ensure that each child is to develop his or her greatest potential.

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Janina Pasaniuc, Cristian Seidler, Daniela Bosioc and Camelia Nistor. Methods and Techniques used in Intercultural youth project

Educational standards are raised when accommodating non-traditional talents by offering a wider variety of opportunities for success.

The three instructional techniques associated with brain-based learning are:

- **Orchestrated immersion** - Creating learning environments that fully immerse participants in an educational experience.
- **Relaxed alertness** - Trying to eliminate fear in learners, while maintaining a highly challenging environment.
- **Active processing** - Allowing the learner to consolidate and internalize information by actively processing it.

**What Brain-Based Learning Suggests**

How the brain works has a significant impact on what kinds of learning activities are most effective. Trainers need to help participants have appropriate experiences and capitalize on those experiences. As Renate Caine\(^1\) illustrates in her book 'Making Connections', interactive elements are essential to this process: Trainers must immerse participants in complex, interactive experiences that are both rich and real. One excellent example is immersing participants in a foreign culture to teach them a second language. Trainers must take advantage of the brain's ability to parallel process. Participants must have a personally meaningful challenge. Such challenges stimulate participant's mind to the desired state of alertness. In order for a participant to gain insight about a problem, there must be intensive

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analysis of the different ways to approach it, and about learning in general. This is what’s known as the "active processing of experience."

A few other tenets of brain-based learning include:

- Feedback is best when it comes from reality, rather than from an authority figure.
- People learn best when solving realistic problems.
- The big picture can’t be separated from the details.
- Because every brain is different, trainers should allow learners to customize their own environments.

Designers of educational tools must be artistic in their creation of brain-friendly environments. Trainers need to realize that the best way to learn is not through lecture, but by participation in realistic environments that let learners try new things safely.

How Brain-Based Learning Impacts learning environment:

Curriculum - Trainers must design learning around participant’s interests and make learning contextual.

Instruction - Trainers let participants learn in teams and use peripheral learning. Trainers structure learning around real problems, encouraging participants to also learn in settings outside the room or the building.
Assessment - Since all participants are learning, their assessment should allow them to understand their own learning styles and preferences. This way, participants monitor and enhance their own learning process.

2.13.6 Experiential Learning Theory:

In the early 1980's, Mezirow, Freire\(^1\) and others stressed that the heart of all learning lies in the way we process experience, in particular, our critical reflection of experience\(^1\). They spoke of learning as a cycle that begins with experience, continues with reflection and later leads to action, which itself becomes a concrete experience for reflection (Rogers, 1996)\(^1\). According to Rogers, learning is facilitated when: (1) the student participates completely in the learning process and has control over its nature and direction, (2) it is primarily based upon direct confrontation with practical, social, personal or research problems, and (3) self-evaluation is the principal method of assessing progress or success Rogers also emphasizes the importance of learning to learn and an openness to change.

According to Kolb's experiential learning theory, learning is the process whereby knowledge is created through the transformation of experience. Experiential learning emphasizes the role that appropriate environments and experiences play in the learning process. The learning process is not identical for all human beings, and people enter learning situations with a preferred learning style. Associated with this learning style there is a theory about how people learn, or more specifically, about how they themselves learn best. Learning

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\(^1\) Janina Pasanuc, Cristian Selder, Daniela Bosioc and Camelia Nistor Methods and Techniques used in Intercultural youth project
\(^1\) Rogers, A., Teaching Adults (2nd ed.). Buckingham: Open University Press. 1996
environments that operate according to a learning theory that is dissimilar to a person's preferred style of learning are likely to be rejected or resisted by that person. Thus an understanding of learning environments is important for educational environments based on multimedia and the Internet.

There are two structural dimensions or degrees of freedom that form the basis for any process of experiential learning. As documented by Kolb, learning is best facilitated in an environment where there is dialectic tension and conflict between immediate, concrete experience (i.e., reality) and analytic detachment (i.e., abstraction) and this constitutes the first dimension called prehension. The second dimension involves the actions of the learner, which transforms experience into knowledge and ranges from a totally physically active to a totally passive (i.e., reflective) state and constitutes the transformation dimension. The prehension dimension ranges from concrete experience to abstract conceptualization whereas the transformation dimension ranges from active experimentation to reflective observation. This explains why some learners learn by being active and trying things out to see what happens. These learners believe in the motto: try it to see if it works. The polarity between concrete experience and abstract conceptualization explains why some learners, young and adult, sometimes favor learning methods, which combine work and study, theory and practice resulting in a more familiar and therefore more productive arena for learning.

2.14 David Kolb's Learning Styles:

Learning style is an individual's unique approach to learning based on strengths, weaknesses and preferences. Each person has a very personal preference as to the way he or she learns. Learning styles are a composite of the cognitive, affective and physiological
factors that serve as relatively stable indicators of how a learner perceives, interacts with and responds to the learning environment. There are two major differences in how we learn, how we perceive and how we process.

**Perception**

**Concrete experience (Thinking) to (Sensing/Feeling) Abstract Conceptualization:**

This is how we take in information, in new situations. Some of us sense and feel our way, while others think things through.

**Sensing/feeling people**

- Connect experience to meaning (connected knowing)
- Perceive through their senses
- Immerse themselves in concrete reality
- Are intuitive.

**Thinking people**

- Separate themselves from the experience (separate knowing)
- Stand back and analyze what is happening
- Reason experience
- Perceive with a logical (cognitive) approach.

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1. Janina Pasaniuc, Cristian Seidler, Daniela Bosioc and Camelia Nistor Methods and Techniques used in Intercultural youth project
Processing:

**Active Experimentation (Doing) to Reflective observation (Watching)**

This is how we process experience and information (how we make it part of ourselves).

Some of us jump right in and try it — active doers; while others watch what’s happening and reflect on it — reflective watchers.

**Reflective people:**

- Reflect on new things
- Filter them through their experience to create meaningful connections.

**Active people:**

- Act on new information immediately
- Reflect only after they have tried it out
- Need to do it in order to make it theirs and extend it into their world.

Each method of perceiving and processing has its own strengths and weaknesses; each is equally valuable; and we all need to use each skill at different times. Experiential learning is conceived as a four-stage cycle: Immediate concrete experience is the basis for observation and reflection; and these observations are assimilated into a "theory" from which new implications for action can be deduced; these implications or hypotheses then serve as guides in acting to create new experiences. Kolb (1984) identified four phases of learning, each of which entails different processes and abilities in acquiring new information:
Feeling or Sensing (Concrete Experience) – Perceive information (becoming fully involved in a new activity in order to understand it firsthand). This dimension represents a receptive experience based approach to learning that relies on feeling based judgments. They generally find theoretical approaches to be unhelpful and prefer to treat each situation as a unique case. They learn best from specific examples in which they can be involved. These learners tend to relate to peers, not authority (they are people persons - they want to get along with others, not be bossed around). Theoretical readings are not always helpful while group work and peer feedback often leads to success. Planned activities should apply learned skills. The instructor acts as coach/helper for this self-directed autonomous learner.

Watching (Reflective Observation) - Viewing experiences impartially or from many different perspectives and reflect on how it will impact some aspect of our life. These individuals rely heavily on careful observation in making judgments. They prefer learning situations such as lectures that allow the role of impartial objective observers. These individuals tend to be introverts. Lectures are helpful to this learner (they are visual and auditory). This learner wants the instructor to provide expert interpretation. They look for an instructor who is both a taskmaster and a guide. This learner wants their performance to be measured by external criteria.

Thinking (Abstract Generalization or Conceptualization) - Creating concepts that integrate observations and experiences into theories and developing explanations or hypotheses that can be generalized and compare how it fits into our own experiences. These individuals tend to be more oriented towards things and symbols and less towards other people. They learn best in authority-directed, impersonal learning situations that emphasize theory and systematic analysis. They are frustrated by and gain little from unstructured "discovery
learning” approaches such as exercises and simulations. Case studies, theoretical readings and reflective thinking exercises help this learner. Very little else helps this learner.

**Doing** (testing in new situation or Active Experimentation) - Using theories to make decisions and solve problems and testing, elaborating generalizations in different situations and think about how this information offers new ways for us to act. These individuals learn best when they can engage in such things as projects, homework, or group discussions. They dislike passive learning situations such as lectures. These individuals tend to be extroverts. This learner wants to touch everything (kinesthetic or tactile). Problem solving, small group discussions or games, peer feedback, and self directed work assignments all help this learner. This learner likes to see everything and determine their own criteria for the relevance of the materials.

2.14.1 Types of learners:

**Assimilators / Theorist** (watching and thinking, or abstract-reflective)

The Assimilator’s dominant learning abilities are Abstract Conceptualization (AC) and Reflective Observation (RO) (lecture, papers, analogies). This person’s greatest strength lies in the ability to create theoretical models. This person excels in inductive reasoning and in assimilating disparate observations into an integrated explanation. Thinkers and watchers take in (perceive) experience abstractly, and they process what they take in reflectively. They like to assimilate a wide range of information and recast it into a coherent, concise logical form and they are keen on basic assumptions, principles, theories, models and systems
thinking. Theorists like to analyze and synthesize. Training approaches - case studies, theory readings and thinking alone. Their strengths lie in their ability to create theoretical models.

Convergers / Pragmatists (thinking and doing, or abstract-active):

The Converger's dominant learning abilities are Abstract Conceptualization (AC) and Active Experimentation (AE) (laboratories, fieldwork and observations). This person's greatest strength lies in the practical application of ideas. Thinkers and doers take in experience abstractly, and then process what they take in actively. They like being exposed to techniques or processes that are clearly practical, have immediate relevance and which they are likely to have the opportunity to implement. Training approach - peer feedback; activities that apply skills; trainer is coach/helper for a self-directed autonomous learner.

Accommodators / Activists:

The Accommodator is best at Concrete Experience (CE) and Active Experimentation (AE) (simulations, case study and homework). Activists take in experience concretely and process what they take in actively. Training approach - practicing the skill, problem solving, small group discussions, peer feedback; trainer should be a model of a professional, leaving the learner to determine her own criteria for relevance of materials.

Divergers / Reflectors (watching and doing, or concrete-reflective):

The Diverger is best at Concrete Experience (CE) and Reflective Observation (RO) (logs, journals, brainstorming). These learners use concrete experience and reflective observation
to generate a range of ideas and they excel at brainstorming and imagining alternatives. Sensors/feelers and watchers take in information concretely, and they process what they take in reflectively. Training approach - lectures with plenty of reflection time; trainer should provide expert interpretation.

Limitations:

- Rogers points out that "learning includes goals, purposes, intentions, choice and decision-making, and it is not at all clear where these elements fit into the Kolb's learning cycle." (Rogers, 1996, p. 108).
- The model takes very little account of different cultural experiences/conditions.
- The idea of stages or steps does not sit well with the reality of thinking.
- Empirical support for the model is weak.

How Experiential learning Impacts Learning environment:

According to Kolb's Experiential Learning Model, there are four learning environments for experiential learning:

1. Affectively Complex: Trainers assign activities where learners are engaged in activities that simulate or mirror what they would 'in the real world.'
2. Perceptually Complex: Trainers want their participants to gain a deeper understanding of a problem by researching, investigating and exploring relationships.

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1 Rogers, A., Teaching Adults (2nd ed.). Buckingham: Open University Press, 1996
2 Janina Pasaniuc, Cristian Seider, Daniele Bosioc and Camelia Nistor. Methods and Techniques used in Intercultural youth project.
3. **Symbolically Complex:** Trainers assign problems that have a correct answer or best possible solution. "In handling such information, the learner is both guided and constrained by externally imposed rules of influence, such as symbols, computer technology, jargon, theorems, graphical keys, or protocols" (Pimentel, 1999).

4. **Behaviorally Complex:** Trainers assign a practical problem and ask participants to use "active application" in trying to solve the problem. The focus is primarily on "doing."

Convergers tend to prefer solving problems that have definite answers. Divergers may benefit more from discussion groups and working collaboratively on projects. Assimilators would feel most comfortable observing, watching role-plays and simulations in class, and then generating concepts. Accommodators may prefer hands-on activities (Sources: Barbara Gross Davis, 1993; Claxton and Murrell, 1987; Erickson and Strommer, 1991; Fuhrmann and Grasha, 1983).

**Curriculum** - Educators must place emphasis on interactive simulations, projects, role play and case studies structured to include understanding of the situation; diagnosis of the problem; creation of alternative solutions; prediction of outcomes; choosing among alternatives; and communicating the results of analysis.

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Instruction - Trainers should design their instruction methods to connect with all four learning styles, using various combinations of experience, reflection, conceptualization, and experimentation by introducing a wide variety of experiential elements. Reflection checklists and questionnaires to help learners to get started on reflecting about their experience by giving them checklists and questionnaires to elicit attitudes and emotional responses. Teach learners how to reflect by giving them an example of how to take a critical and analytical approach.

Assessment - Trainers should employ a variety of assessment techniques, focusing on the development of "whole brain" capacity and each of the different learning styles. Encourage self-assessment during reflection by making it a formal requirement. Learners can submit self-assessment sheets listing strong and weak features of their work and a self-assigned grade together with every piece of work submitted for assessment.

2.15 Motivational theories:

Motivation has been defined as "the process whereby goal-directed activity is instigated and sustained" (Pintrich and Schunk, 1996)*, and as "that which determines the magnitude [degree of effort] and direction [goal-orientation] of behavior" (Keller and Burkman, 1993)†. Developing life-long learners who are intrinsically motivated, display intellectual curiosity, find learning enjoyable, has always been a major goal of education. Motivation is a goal-directed

behaviour instigated and sustained by expectations concerning the anticipated outcomes of actions and self-efficacy for performing these actions.

Charles B. Hodges, in his paper, “Designing to Motivate: Motivational Techniques to Incorporate in E-Learning Experiences” addresses the construct of motivation as it relates to learning. He mentioned in his paper that Bandura (1997) identifies three different forms of motivation around which different theories have been built. Those theories are attribution theory, expectancy-value theory, and goal theory. Goal theory assumes that establishing goals to be obtained motivates behavior. The goals set by the learners may be learning goals or performance goals. Performance goals are goals that center on some evaluation of one’s competence in a specific area. For instance, a learner may set the following goal: “I want to get at least a 90% on my integration test”. This is a performance goal. The learner wishes to meet a certain performance level compared to some set scoring standard. If the learner stated the goal, “I want to understand integration,” that would be a learning goal. The goal is centered on the learner developing new skills, knowledge, or attitudes and is not aiming for some performance level or judgment. Goal theory has many connections to self-efficacy. Two connections between self-efficacy and goal theory are detailed as follows. One’s perceived abilities will dictate what types of goals an individual sets. Also, as one works toward achievement of a goal, the successes and failures along the way will contribute to his or her beliefs of self-efficacy. Within all of these theories are the concepts of intrinsic and extrinsic motivation. Intrinsic motivation refers to a learner’s internal desire to perform a task for no reward other than the personal satisfaction or enjoyment. When a learner is motivated by rewards and incentives external to the learner’s interest and satisfaction, these factors are

termed extrinsic motivators. Clearly, the most desirable form of motivation is intrinsic (Husen & Postlethwaite, 1994, p. 39,41).

In attribution theory, a learner attributing success to ability results in heightened beliefs of personal efficacy, which, in turn, predict the learner's future results. Attribution Theory, proposes that individuals try to explain their successes by four attributions: external/uncontrolled (e.g. luck), external/controlled (e.g. task difficulty), internal/uncontrolled (e.g. ability), or internal/uncontrolled (e.g. effort). To keep students motivated and encouraged, instructors should always aid them towards an internal/controlled attribution. Students who feel that they have control over the situation will continue to make an effort to succeed, while those who attribute success or failure to uncontrolled factors will feel that their effort is not going to change the circumstances.

Expectancy Theory suggests that a learner's motivation depends on three main factors: expectancy, instrumentality, and valence. A learner's expectancy (perception of effort needed to succeed) is based on self-efficacy/confidence, goal difficulty and feeling of control over performance. By increasing each of these factors, their expectancy level increases, leading the motivation to also increase. Instrumentality (award for their performance) and valence (value or attractiveness of the reward) also need to increase in order for the motivation to increase. An instructor's role therefore can be to try to increase each of these factors, such as a learner's self-confidence and feeling of control, as well as to give awards for desired behavior. If one applies expectancy value theory, once a success is achieved at learning a

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particular task, self-efficacy is increased and thus the likelihood of attempting the task in the future is increased.

2.16 Bringing the theories together: The ARCS model

Keller developed the ARCS model of motivation partially in response to different theories of motivation such as goal theory, attribution theory and expectancy theory. Keller (1987) synthesized the many concepts and theories of human motivation into a simple, meaningful model, or schema that would be useful to a practitioner and developed a systematic, approach to designing motivating instruction. The ARCS model works under the assumption that learners will be motivated if they feel they can be successful and that there is value in their learning. Hence, this model works within the boundaries of expectancy-value theory. Based on the "expectancy-value" theories, Keller argues that students will be motivated to learn when they perceive some personal value and satisfaction from the effort, and when they expect to succeed. Taking those two principles and extending them, Keller came up with four basic elements of motivational theory (and created a handy acronym that is easy for practitioners to remember): attention, relevance, confidence, and satisfaction. Each element of the model includes suggestions for implementation.


Attention:

Attention is basically the direction of students' attention to the appropriate stimuli. As a requirement for learning to take place, students must be attentive to the learning environment and remain so throughout the experience. Failure to gain students' attention will prevent any learning from taking place; failure to keep students' attention will cause students to not complete the learning objectives. Caution must be taken, however, to avoid the painfully common practice of over stimulating students in an attempt to keep their attention. Keller (1987') recommends using cognitive engagement techniques to pique students' curiosity and activate information-seeking behavior throughout instruction. Using participative learning, problem-solving techniques, and inquiry learning are common methods that teachers integrate such cognitive engagement. Additionally, varying the media, modality, and style of the presentation of information can keep students' attention, as can the judicious use of humor.

Relevance:

Unfortunately, the most common method of integrating relevance into instruction is the invocation of future career goals. Though this can be a powerful method of creating relevance, relying solely on this technique can leave instruction un-motivating for some students. Content can also be relevant based on past knowledge, for instance, or non-work interests. Keller (ibid., 1987) postulates, however, that it is not only content that can provide relevance for learners. Designing learning experiences based on individuals' different

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learning styles can also provide such relevance. For instance, Keller says that learners with a high need for "need for affiliation" will tend to enjoy classes in which they can work cooperatively in groups (Keller, 1987). Others might find working alone to be more challenging and rewarding. Determining and meeting needs like these through instructional design will help ensure that learning has relevance for students. Allowing students to make choices in instruction can also have an impact on perceived relevance.

Confidence:

Fear of failure in educational endeavors is, according to Keller (op. cit., 1987), much more common than teachers and instructional designers believe. In fact, many learners inappropriately attribute their efforts: if they succeed, often students believe it is because the task was too easy; if they fail, on the other hand, it is because they are not smart enough to complete the task. Insuring that students feel some level of expectancy for success will keep them motivated to continue, as will being careful to accurately attribute student learning to effort expended. When designing instruction for learner confidence, structure experiences such that, with some reasonable amount of effort, students can accomplish tasks by themselves. Gradually making tasks more difficult (but able to be accomplished) as students learn more also builds students' confidence in their abilities.

Satisfaction:

The last element of the model, satisfaction, involves the relatively delicate balance between learner and instructor control. Creating a clear reward structure can be motivating to learners, especially when they're going through rote or unpleasant exercises that require such extrinsic reinforcements. However, if a learner is intrinsically motivated to some degree (for instance, if the subject matter is particularly interesting to a student), he or she may feel resentment at being forced to complete tasks in order to receive the rewards; this can result in loss of motivation. To help keep students motivated, teachers should develop a reward structure that reflects these considerations and look for ways to develop intrinsic motivational factors throughout the instruction.

How motivational theory impacts Learning environment:

When designing learning experiences, one should take this into consideration and make every effort to increase the students' self-efficacy. It is apparent that an e-learning experience should be designed with relevant and authentic experiences for the learners. E-learning experiences that are motivating include a simple, consistent and easily understood navigation and feedback mechanisms that are meaningful and adaptive. Curriculum needs to be motivating with relevance to the social and cultural environment of the learners so that students find it more meaningful and interesting. The curriculum shall cover the real life applications of the concepts students learn. The curriculum should take into account the prerequisites and level of understanding expected from the learner while providing flexibility to accommodate learner diversity. The assessment should be well integrated into the
curriculum so that learners develop confidence and satisfaction with appropriate self-assessment and guidance from teachers.

Keller (1987) breaks each of the four components down into strategy sub-components.

Attention:

Perceptual Arousal: provide novelty, surprise, incongruity or uncertainty using facts that contradict a learner's intuition, a visual stimuli, story and active participation of learners by involving them with role playing, games, lab work or other simulations that allows them to get them involved with the material or subject matter.

Inquiry Arousal: stimulate curiosity by posing questions or problems to solve. Ex. The teacher presents a scenario of a problem situation and asks the class to brainstorm possible solutions based on what they have learned in the lesson.

Variability: incorporate a range of methods and media to meet students' varying needs by varying the delivery or format of the instruction. Ex. After displaying and reviewing each step in the process on the overhead projector, the teacher divides the class into teams and assigns each team a set of practice problems.

Relevance:

Emphasize relevance within the instruction to increase motivation by using real world examples with which the learners are familiar.

Goal Orientation: Present the objectives and useful purpose of the instruction and specific methods for successful achievement stating how the instruction relates to the learners at the present time, or how it will help them meet future goals. Ex. The teacher explains the objectives of the lesson.

Motive Matching: Match objectives to student needs and motives by incorporating a choice in methods of accomplishing course goals into the instruction, allow the learners to use different methods to pursue their work or allowing choice in how they organize. Ex. The teacher allows the students to present their projects in writing or orally to accommodate different learning needs and styles.

Familiarity: Present content in ways that are understandable and that are related to the learners' experience and values as we learn by building upon our preset knowledge or skills. Ex. The teacher asks the students to provide examples from their own experiences for the concept presented in class or arrange enthusiastic guest lectures by those who finished the course, relating how the course helped them.
Confidence:

Allow the learners to succeed! However, present a degree of challenge that provides meaningful success so that learners become confident.

Learner Control - Learners should feel some degree of control over their learning and assessment should believe that their success is a direct result of the amount of effort they have put forth. Learners should understand that there is a correlation between the amount of energy they put into a learning experience and the amount of skill and knowledge they will gain from that experience.

Learning Requirements: Inform students about learning and performance requirements and assessment criteria. Clearly state learning goals and help students in setting realistic goals. Ex. The teacher provides students with a list of assessment criteria for their research projects and circulates examples of exemplary projects from past years.

Success Opportunities: Provide challenging and meaningful opportunities for successful learning by organizing materials in order of increasing difficulty and attributing success to effort. Provide feedback and support internal attributions for success. Ex. The teacher allows the students to practice extracting and summarizing information from various sources and then provides feedback before the students begin their research projects.

Personal Responsibility: Link learning success to students' personal effort and ability and allowing students to become independent learners. Ex. The teacher provides written
feedback on the quality of the students' performance and acknowledges the students' dedication and hard work.

**Satisfaction:**

We need to provide opportunities to use newly acquired knowledge or skill in a real or simulated setting along with feedback and reinforcements that will sustain the desired behavior. If learners feel good about learning results, they will be motivated to learn. Satisfaction is based upon motivation, which can be intrinsic or extrinsic. Intrinsic Reinforcement results if we encourage and support intrinsic enjoyment of the learning experience. Extrinsic Rewards provide personal attention, positive reinforcement and motivational feedback. Equity by way of consistent standards and consequences for success also ensures satisfaction.

2.17 Instructional design:

Instruction design is a systematic approach towards achieving learner-centric goals by creating an effective learning environment with appropriate design principles depending on the learners and the situation. Different learning theories apply in different contexts and hence eclectic models are applied to instruction design by synthesising the principles of learning theories appropriate to the situation. Instructional Design and Instructional Systems Design are scientifically derived processes which are intended to optimize learning gains in knowledge and performance from precisely engineered (and designed) instruction. There are
at least four different aspects of instruction that influence student performance. These include: (1) ways of organizing the instruction, such as sequencing and formatting the subject-matter content; (2) ways of delivering the instruction, which is usually a matter of media selection; (3) ways of motivating students; and (4) ways of managing the interaction between the student and the instruction. Instructional organization can be further divided into two categories: (1) ways of organizing the instruction on a single topic and (2) ways of organizing instruction that interrelates sets of topics such as sequencing the topics, the use of overviews, advance organizers and various kinds of sequencing (Reigeluth 1979; Reigeluth and Merrill 1978).

The instructional designer must understand the strengths and weaknesses of each learning theory to optimise their use in appropriate instructional design strategy. Trying to tie Instructional Design to one particular theory is like school vs. the real world. What we learn in a school environment does not always match what is out there in the real world, just as the prescriptions of theory do not always apply in practice, the real world. Posner and Strike described a set of strategies for sequencing the instruction based on learning related, world related and concept related content. A model can accommodate various strategies by presenting the content in a non-linear way. Logical pre-requisite sequencing can be embedded in concept related sequencing. Bloom demonstrated that if time is not held constant for all learners then a student's mastery of prerequisite skills, rather than aptitude is

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a better predictor of school learning. So students shall be given enough time to learn and are provided by quality instruction, which provides opportunity for self-paced learning with structured content in small modules and appropriate sequencing. Quality instruction requires that the subject matter should be organized into manageable learning units with specific learning objective followed by assessment and feedback. The overall design of the content can also capture some of the conditions for learning suggested by Gagne. Each lesson can be started with a thought provoking question or interesting facts centered around a theme.

Instructional Design is a disciplined approach towards achieving learner-centric goals by making learning more effective and empowering. Design interventions bridge the gap between technology and human experience. Systematic efforts at design not only simplify the content, it makes it easy and engaging to learn, thereby enhancing the learning experience. An instructional designer designs learnscapes by formulating and implementing appropriate learning strategies. Teachers embark on design activities for re-purposing their classroom materials, textbooks and other presentation to develop effective e-learning modules for their institutions. They either learn design theory or rely on their experience and learning from similar projects. The context, the content and the learners are three important variables which influence design and we need to study the dependencies between these variables and strive for a balance in the form of sound instructional strategies that can optimise learnability of the content.

Ertmer and Newby* after comparing the strengths and weaknesses of various learning theories and perspectives, did not advocate one single learning theory, but stressed that instructional strategy and content addressed depend on the level of the learners. They feel that the instructional approach used for novice learners may not be efficiently stimulating for a learner who is familiar with the content. Similar to Jonassen, they match learning theories with the content to be learned: a behavioural approach can effectively facilitate mastery of the content of a profession (knowing what); cognitive strategies are useful in teaching problem-solving tactics where defined facts and rules are applied in unfamiliar situations (knowing how); and constructivist strategies are especially suited to dealing with ill-defined problems through reflection-in-action (Ertmer and Newby, ibid., 1993).

**Behavioural**

Tasks requiring a low degree of processing (e.g., basic paired associations, discriminations, rote memorization) seem to be facilitated by strategies most frequently associated with a behavioral outlook (e.g., stimulus-response, contiguity of feedback/reinforcement).

**Cognitive**

Tasks requiring an increased level of processing (e.g., classifications, rule or procedural executions) are primarily associated with strategies having a stronger cognitive emphasis (e.g., schematic organization, analogical reasoning, algorithmic problem solving).

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*Ertmer, P. A., Newby, T. J., Behaviorism, cognitivism, constructivism. Comparing critical features from an instructional design perspective. Performance Improvement Quarterly 6 (4), 50-70 1993*
Tasks demanding high levels of processing (e.g., heuristic problem solving, personal selection and monitoring of cognitive strategies) are frequently learned with strategies advanced by the constructivist perspective (e.g., situated learning, cognitive apprenticeships, social negotiation----- Ertmer and Newby, 1993).

Ertmer and Newby (ibid., 1993) believe that the strategies promoted by different learning theories overlap (the same strategy for a different reason) and that learning theory strategies are concentrated along different points of a continuum depending on the focus of the learning theory - the level of cognitive processing required. Ertmer and Newby's suggestion is that theoretical strategies can complement the learner's level of task knowledge, allows the designer to make the best use of all available practical applications of the different learning theories. With this approach the designer is able to draw from a large number of strategies to meet a variety of learning situations. Reigeluth's Elaboration Theory⁷ which organizes instruction in increasing order of complexity and moves from prerequisite learning to learner control may work in the eclectic approach to instructional design, since the learner can be introduced to the main concepts of a course and then move on to more of a self directed study that is meaningful to them and their particular context.

There is a place for each theory within the practice of instructional design, depending upon the situation and environment. The idea of using an objective approach to provide the learner

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with an "anchor" before they set sail on the open seas of knowledge may be preferred as basic understanding of the material in question provides the learner with a guiding compass for further travel. Instruction design for a school environment requires the designer to provide material that fosters an individual to find divergent approaches to problem solving where as in training for business world, instruction designer is required to establish and meet the objectives of business. The designer needs to find solutions to the diverse learning requirements of the 21st century by way of intelligent application of learning theory strategies and technologies.

2.18 Process of Instruction design:

Instructional designers are expected to be familiar with the epistemological underpinnings of several theories and their consequences on the process of instruction. Yiasemina Karagiorgi and Loizos Symeou in their article, 'Translating Constructivism into Instructional Design: Potential and Limitations', stated that application of the principles underlying constructivism, particularly active, collaborative and authentic learning on the process of instructional design are namely - analysis, development and evaluation. The process of instructional design poses certain challenges with regards to issues such as pre-specification of knowledge, authentic evaluation and learner control. Most of the problems are attributed to the fact that constructivism is a learning theory and not an instructional-design theory. Therefore, instructional designers must attempt to translate constructivism into instructional design through a more pragmatic approach that focuses on the principles of moderate - rather than extreme - constructivism and makes use of emergent technology tools. This shift

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Karagiorgi, Y., & Symeou, L., Translating Constructivism into Instructional Design: Potential and Limitations, Educational Technology & Society. 8 (1), 17-27, 2005
could facilitate the development of more situated, experiential, meaningful and cost-effective learning environments. In spite of all the problematic areas, the future of constructivism can be optimistic in this field. To enable the transition from theory to practice, there are two important points for consideration. First, that pragmatic constructivism could be built on moderate theoretical assumptions that are more compatible with instructional design practices and second, that the emergence of rich constructivistic environments can be facilitated by the emergence of powerful technology tools. Practical model building along with the eclectic application of learning strategies and technology can help designers accommodate the constructivist perspective so as to respond to the learning requirements of the 21st century.

Analysis:

Analysis, seeks to define the learning objectives, identify the learning issues and knowledge gaps that indicate key areas for learner improvement. This involves processes like needs analysis, content analysis, context analysis to get an overview of the requirements and viable approaches to meet the requirements. The instructional designer analyses the conditions - such as the content, the learner, and the instructional setting, which have a bearing on the design for intended learning outcomes. Constructivist designers are in favor of environments in which knowledge, skills, and complexity exist naturally. Since objects and events have no absolute meaning, the design task is one of providing a rich context within which meaning can be negotiated, and ways of understanding can emerge (Hannafin et al., 1997). Therefore, designers develop procedures for situations in which the instructional

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context plays a dominant part and the instructional goals evolve as learning progresses (Tam, 2000). Thus, constructivists do not adopt learning and performance objectives that are internal to the content domain and instead they "search for authentic tasks and let the specific objectives emerge and be realized as they are appropriate to the individual learner in solving the real-world task" (Bednar et al., 1992, p. 25). The goal, for instance, is not to teach a particular version of history but to teach someone how to think like a historian.

Design and development:

The output of analysis phase helps us in developing a strategy for learning. The design phase seeks to provide detailed guidelines for the implementation of instructional strategy to accomplish learning goals effectively. In traditional instruction, this phase involves the design of a sequence to achieve specified performance objectives (Skaalid, n.d.). Draper (1997) states that the instructional design of the Gagne school takes instructional objectives and subdivides them, ending up with a set of small items, for each of which a separate instructional action is taken. This phase involves detailed documentation of learner, content and context. Content structuring, sequencing, presentation and delivery forms part of the design. Designers who base their design on cognitive perspective give importance to ways of reducing the extraneous cognitive load through appropriate content sequencing principles such as Merrill's component display theory or Reigeluth's elaboration theory.

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Constructivist designers assume that every learner has a unique perspective. So the
concept of the global 'average' learner is rejected (Bednar et al., 1992). Constructivists are
also interested in the learner's prior knowledge in terms of cognitive processes and self-
reflective skills (Vrasidas, 2000). Instructional designers must confront students with
information and experiences that threaten their 'misconceptions' and offer support to this
reflective process. Since learning occurs as an act of cognitive restructuring, students'
metacognitive capabilities are augmented (Greening, 1998). Correspondingly, designers are
interested in the learners' skills of reflexivity and not on remembering (Bednar et al., op. cit.,
1992). Constructivists point to the creation of instructional environments that are student-
centered, student-directed, collaborative, supported with teacher scaffolding and authentic
tasks and based on ideas of situated cognition, cognitive apprenticeship, anchored instruction
and cooperative learning. Such learning environments involve an abundance of tools to
enhance communication and access to real-world examples, reflective thinking, multiple
perspectives, modeling or problem solving by experts in a context domain and mentoring
relationships to guide learning.

Evaluation:

Not any interpretation or opinion is as good as any other and the learners are not free to
construct any knowledge. The concepts, ideas, theories and models constructed are both
built and tested. They will only survive in terms of viability and 'usefulness' in a pragmatic or

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1 Bednar, A. K., Cunningham, D., Duffy, T. M., & Perry, J. D., Theory into practice: How do we link? In Duffy, T. M.,
& Jonassen, D. H. (Eds.), Constructivism and the technology of instruction: A conversation. Hillsdale: Lawrence
Erlbaum Associates, 17-34. 1992
2 Vrasidas, Ch. (2000). Constructivism Versus Objectivism: Implications for Interaction, Course Design, and
Evaluation in Distance Education. International Journal of Educational Telecommunications, 6 (4). 339-362. 2000
Technology, 38 (2), 23-35. 1998
instrumental sense in the context they arise, and in terms of whether they either do or do not do what they claim to do (Spiro et al., 1991b). In other words, even though the learner is free to build a personal interpretation of the world, this interpretation has to be coherent with the general 'Zeitgeist' (Cognition and Technology Group at Vanderbilt, 1991a).

Evaluation in the constructivist perspective examines the thinking process. As there are more than one ways of solving a problem, each student's approach is more important than a particular solution (Cole, 1992). The students' ability to explain and defend decisions is an important element of evaluation and is related to the development of metacognitive skills and self-reflexive processes. Therefore, by looking at the learning activity itself and at the child's ability to reflect upon or discuss that activity, assessment emerges from task performance (Duffy & Jonassen, 1991). This 'understanding performances' principle (Perkins, 1991a) also implies that evaluation calls for measures of transfer of learning and emphasis on student responsibility and autonomy. Learners have an active and critical role in assessing their own learning by articulating what they have learned and how they have made the connections to their previous experiences (Lambert et al., 1995). In general, evaluation methods are context-driven as they assess knowledge construction in real-world contexts that are as rich as those used during the instruction (Jonassen, 1992).

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The challenges:

Learner diversity:

Instructional designers need to accommodate diverse entry-level skills and competency levels of learners besides their learning styles. If each individual is responsible for knowledge construction, then designers cannot determine and ensure a common set of outcomes for learning (Jonassen, 1994). The evident autonomy of learners in knowledge construction makes it difficult, if not impossible, to predict how learners will learn or how to plan instructional activities. Hence, constructivist instruction is from a theoretical perspective at least, an oxymoron (Jonassen, ibid., 1994).

Learner control:

Constructivists offer the learner almost unlimited discretion to select what is studied, from among available resources and how it is studied. However, this creates problems of accountability that students will learn. Learners might construct the wrong knowledge, skills and abilities since some students just want to be told what they need to learn (Perkins, 1999). Merrill (as cited in Draper, 1997) points out that appropriate learner guidance will make learning far more effective than ‘sink or swim’ exploration. He further continues that allowing students to structure their own learning in ‘ill structured’ environments is “not a great virtue but abdication of our responsibility as teachers and instructors. Students do not know

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or understand their own learning mechanisms" (p. 6). Therefore, not all learners benefit from having almost unlimited control over their own learning (O’Donnell, 2000).

Evaluation:

Evaluation - the other 'end' of the instructional process - has also produced differences between constructivists and designers. Jonassen (1992) describes evaluation as the thorniest issue yet to be resolved regarding the implications of constructivism for learning and points to the need for evaluation methodologies that possess the cognitive sophistication implied by constructivism. As evaluation becomes demanding, Cey (2001) suggests that peer-assessment and self-assessment must be incorporated.

Since there are complementary design tools to be applied in different contexts, instructional designers can be eclectic and apply such theories of instructional design in the proper setting and context. Some learning problems require highly prescriptive solutions, whereas others are more suited to learner control of the environment. For example, pre-determined, constrained, sequential, criterion-referenced instructional design is most suitable for introductory learning while constructivist approaches are more appropriate for advanced knowledge acquisition (Mergel, 1998).

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2.19 New Way of Learning: e-learning

Definition of e-learning:

E-Learning is used synonymously with Technology-based Learning and covers a wide set of applications and processes, including computer based learning, Web-based learning, virtual classrooms, and digital collaboration. e-learning is defined as the delivery of content via all electronic media, including the internet, intranets, extranets, satellite broadcast, audio/video tape, interactive TV, and CD-ROM. e-learning is the acquisition and use of knowledge distributed and facilitated primarily by electronic means. This form of learning currently depends on networks and computers but will likely evolve into systems consisting of a variety of channels and technologies as they are developed and adopted.

What The “e” Is About

- Exploration: e-Learners use the Web as an exploratory tool to access a plethora of information and resources.
- Experience: The Web offers e-Learners a total learning experience, from synchronous learning to self-paced study.
- Engagement: The Web captivates learners by enabling creative approaches to learning that foster collaboration and a sense of community.
- Ease of use: Not only is the Web easy to use for learners who are already familiar with the navigation capabilities of the medium, but to learning providers as well, as

they can easily make content immediately available to learners across all technical platforms (Windows, N4AC, Unix, etc.).

- Empowerment: The Web puts learners in the driver's seat with a set of tools that enables personalization of content and allows learners to choose the way in which they best learn.

2.20 Best Practices of e-Learning:

To make e-learning successful, the technology must have several characteristics that make the learner's and the instructor's experience enjoyable. One of the secrets to successful e-learning implementations is to choose the correct software for the correct need'. Generally, there are five types of e-learning software that can be used alone or in combination. These are:

- Programming Languages
- Authoring tools
- Learning Management Systems
- Content Management Systems
- Learning Content Management Systems

Programming Languages: Hyper Text Mark Up Language (HTML) is the most widely used programming language for developing simple online learning. Java, JavaScript, PHP, PEARL or even CGI scripting languages increase the level of interactivity in online learning.

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**Authoring tools:** These tools are designed specifically to overcome the difficulty of using programming languages. Placing the proper information in the right place is the only task of the instructor. The software takes care of coding interactions and functionality in the background. Macromedia's Dreamweaver and products like TrainerSoft and Lectura are some of the widely used authoring tools.

**Learning Management Systems (LMS):** LMS e-learning platforms can track and store user performance on built in assessment; they can track the hit rate to a particular area of the site; and they can track the amount of time a learner has spent in a certain area of the course. LMS facilitates students to register for courses, check grades, get remainders, chat and participate in group-discussions with the other members. Ex: Blackboard, e-College, WebCT, Saba and Click2learn's Aspen.

**Content Management System (CMS):** Tracking, cataloging and manipulating the online content like graphics, sound files, video files, and text files can be done by CMS. A CMS is a database of content, which is assigned keywords and extensive search capabilities so that an instructor or developer can easily locate what he or she is seeking. CMS facilitates content reusability.

**Learning Content Management Systems (LCMS):** LCMS takes care of every e-learning software need. Tasks like Content authoring, user tracking and reusability of the content can be efficiently handled by LCMS.
2.21 ID in e-Learning Environments:

Systematic efforts at design, simplifies the content and makes it easy to learn. Content design is one of the important aspects of learning environment as application of suitable instruction design methodology creates an engaging learning experience. Instruction design models are based on learning theories and there is a perceptible shift from Behavioural principles to Cognitivism and Constructivism. There are a variety of methods of sequencing instruction, which place the learner rather than the content as the central focus. These are described in Posner and Strike (1976)\(^1\) and outlined here. These methods of sequencing reflect a more constructivist approach to learning with the student at the centre of the learning activity.

Learner Related Sequencing

This method relies on the learner analysis done earlier. The designer assesses characteristics of the material such as familiarity, identifiable prerequisites, difficulty, interest, and developmental level of the learner. Sequencing is varied to maximize learner interest based on the designer's perception of the learner's needs and interests.

World Related Sequencing

World related sequencing presents material as it would be experienced in the real world. It may be organized as experienced physically (spatial), in time (temporal), or by similarity of

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\(^1\) Posner G. J., & Strike K. A. A categorisation scheme for principles of sequencing content. Review of Educational Research, 46, pp 665-690
appearance (physical). This method of sequencing makes use of the learners existing background of experience and builds on that knowledge.

Concept Related Sequencing

Concept related sequencing is based on how we perceive our world to be organized. It is a more abstract approach than the previous two in that it relies on individual conceptual mapping of perceived reality but it offers other alternatives to the instructional designer. Concept sequencing includes: Class relations – characteristics of a class of things or events are presented first followed by individual variations within the class. relationships between propositions such as chemical reactions are presented before a specific chemical concept. Sophistication relationships – begin with simple concepts and advance to complex ideas. Logical prerequisites – required concepts are presented first and built on with increasingly complex material.

When adopting one or more of these learner centered sequencing methods, the instructional designer must pay considerably more attention to the learner characteristics. Tailoring presentation of content may require pre-testing to determine specific learner abilities and some method of adjusting for learner diversity within the learning package. This increases design complexity but will result in a more functional end product for the learners.

2.22 Embedding instructional design elements into e-learning environment:

Successful e-learning environments are created using eclectic instructional design principles and there cannot be a single universal model that could be followed for designing
and developing all types of instruction. However systematic efforts at design not only simplify
the content, it makes it easy and engaging to learn, thereby enhancing the learning experience.

The context, the content and the learners are three important variables which influence
design and we need to study the dependencies between these variables and strive for a
balance in the form of sound instructional strategies that can optimize learnability of the
content. The challenge that remains for e-Learning is to combine instructional design theories
with the technology dimension so that high quality courses are provided. It is, thus, imperative
that the approach to the design of e-Learning courses should be grounded, not only in web
interface design guidelines, but also in learning theories. The instructional designer and the
web interface designer can communicate on a common basis and have common set of
criteria to assess whether the instructional objectives were met as given below:

**General Lesson Structure:**

All lessons will be accessed through a selection menu at the start of the package. Learners need to know where they are going and what they have to complete. Approximate
times for completion and progress indicators are essential for a learner who is organizing
their own learning.

**Interaction and exploration:**

As a general rule, interaction is required from the learner at least once every three to four
frames and inserted at logical points in the lesson instead of in the middle of logical thought.
The aim is to maximise learner participation by making them active learners rather than passive learners; engage and engross them in the learning material. Taking cognisance of the merits of constructivism, and the fact that people learn in a variety of ways, learners should be able to explore the package and determine their own sequence.

**Micro Strategies:**

All multimedia courseware must contain micro strategies (or learning aids) to help the learner recall, retain and apply their acquired knowledge. Micro strategies such as chunking of information, mnemonics, icons and linkages are to be used.

**Feedback and Performance Analysis:**

Feedback should be provided for both right (reinforcement) and wrong (remediation) responses. All learning should be verified through an evaluative conclusion in creative ways. All courseware must contain some form of assessment with relevant learning objectives. A learner should always be given an assessment of their overall performance.

Poulymenakou Angeliki, Moraiti Asimina, Bisbiki Eleni. in their paper "When Instruction Meets Design: Embedding Instructional Theory Elements into eLearning", have suggested a set of generic e-Learning interface design guidelines.

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1. Poulymenakou Angeliki, Moraiti Asimina, Bisbiki Eleni. "When Instruction Meets Design: Embedding Instructional Theory Elements into eLearning."
1: Promote the use of graphics

Instructional theory elements

- Appropriate presentation of the material (Gagne\(^*\))
- Appropriate presentation forms for each type of objective (Merrill\(^*\))
- Successful avoidance of the split attention effect (Sweller\(^*\))
- Use of multiple channels (Sweller, *ibid.*)

Implementation in Web Interface:

When the designer wants to present specific content items (such as relations among concepts, quantitative data), with graphical representation she can help the learner to deeper comprehend and retain the educational material. The graphical information presentation contributes in the better exploitation of the learner's optical channel possibilities combining written speech with pictures.

2: Maintain the contiguity related items

Instructional theory elements:

- Successful avoidance of the split attention effect (Sweller, *ibid.*)
- Effective performance elicitation, feedback provision, performance assessment (Gagne, *op.cit.*)
- Appropriate presentation of the material (Gagne, *op.cit.*)
- Appropriate presentation forms for each type of objective (Merrill, *op.cit.*)

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Implementation in Web Interface:

When relative information is close, the learner has all the required information available. Thus, she can make a logical connection in her mind and retain it better. The learner has direct access to the question instructions and can follow them step-by-step. The learner is not required to move to many screens to see the question, the answer and the feedback on her answers. Thus, she can connect the questions with her answers and retain knowledge better.

3: Promote the use of audio in graphics description

Instructional theory elements

- Avoidance of redundancy in instruction (Sweller*)
- Appropriate presentation of the material (Gagne†)
- Appropriate presentation forms for each type of objective (Merrill‡)
- Use of multiple channels (Sweller, op. cit.)

Implementation in Web Interface:

The learners' visual channel demands are decreased, since graphics enter through this channel, while narrative enters through the auditory channel. When information is not unnecessarily repeated, the learner does not have the process visual and auditory information at the same time and her cognitive load is reduced.

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4: Provide appropriate navigation support

Instructional theory elements

- Evident learner-control format (Reigeluth)
- Decrease in cognitive load (Sweller)
- Adequate learning guidance (Gagne)

Implementation in Web Interface:

Navigation support helps the learner in a way that she does not have to remember the essential information each time she navigates the course. The learner has the possibility to comprehend the course structure and, thus, to move to any point of the course, according to her educational needs. The learner comprehends exactly where she is at the moment and knows how to navigate this point forward. When the learner knows beforehand where she goes, she can navigate better through the course.

5: Attain e-Learning content coherence

Instructional theory elements

- Adequate learning guidance – semantic encoding (Gagne, ibid.)
- Decrease in cognitive load (Sweller, op.cit.)

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Implementation in Web Interface:

The process to learn the system is simplified and the learner is not confused. The learner does not have to abort the admissions she has made from the interfaces she has already encountered. Since the learner has learnt the way that the various indications operate once, she can use them repeatedly.

6: Support interactivity

Instructional theory elements

- Evident learner-control format (Reigeluth)
- Decrease in cognitive load (Sweller)

Implementation in Web:

Information is not presented in a linear way, but the learner can control information attainment, processing and presentation through links that contain the relative information. The information presented is short, so that the learner's memory is not overloaded.

7: Organize links to create a useful course menu

Instructional theory elements

- Comprehensible Content hierarchy (Reigeluth, op.cit.)
- Stimulate recall of prior knowledge (Gagne)
- Decrease in cognitive load (Sweller, op.cit.)
Implementation in Web Interface:

Menus help the learner comprehend the course structure and navigate better through the course, according to her educational needs. Having all the relevant information already organized, the learner does not have to make an additional effort to unify it. The learning environment contains words and phrases compatible with the learner's context, so that the learner can immediately comprehend them, without further effort.

8: Provide help
Instructional theory elements

- Adequate learning guidance (Gagne\textsuperscript{1})

Implementation in Web Interface:

The learning pace accelerates, since the learner avoids losing time in false actions. The learner distinguishes important information from less important.

9: Provide appropriate screen design
Instructional theory elements

- Continuous retention of learners attention (Gagne, ibid.)
- Successful avoidance of the split attention effect (Sweller\textsuperscript{2})

Appropriate presentation of the material (Gagne')

Appropriate presentation forms for each type of objective (Merrill')

Implementation in Web Interface:

The learner organises the provided information and creates a hierarchical structure depending on the importance of information. The learner relates the provided information, so that she can comprehend the relation among the different meanings and compose the general meaning, according to her perception of the environment.

2.23 Impact of instruction design on Learning Environment:

2.23.1 Enjoy learning:

Students enjoy learning if they are motivated and find the learning environment engaging and enriching. According to Keller's ARCS model learners are motivated if their attention is sustained with active involvement in the learning process through role-play, practicals, simulations and projects. Real world examples with which the learners are familiar enhance learner motivation. Instruction design, which provides challenging and meaningful opportunities for successful learning enables students in to attributing success to their personal effort and develop confidence. Students also enjoy learning if the subject matter is

presented in a way, which is simple and easy to understand. Principles of CDT and elaboration theory help the instruction designers and teachers to present the content with structured sequencing so that learners find the content simple and easy to understand. Learners enjoy interactivity, which ensures learner control and reduced cognitive load.

2.23.2 Active Learning:

According to constructivism, the centre of instruction is the learner. Meaningful understanding occurs when students develop effective ways to resolve problems related to real world situations. Such situations foster motivation, because students have an opportunity to experience the pleasure and satisfaction inherent in problem solving. Perkins (1991a) points to the need for discovery learning through two approaches of constructing knowledge: 'Without the Information Given' (WIG) and 'Beyond the Information Given' (BIG). The emergence of environments - such as toolkits and phenomenaria, virtual reality simulations, multimedia, socratic dialogues, coaching and scaffolding, role-playing games, simulations, storytelling structures, case studies could promote instructional strategies that facilitate more active construction of meaning.

2.23.3 Learning How to learn:

As Jonassen (1990) notes: In order to be a physicist, learners must think like physicists, but thinking like a physicist is different than thinking like an artist. Not only are the knowledge domains different, but the ways of thinking about them also differ (p. 34). A rich learning environment encourages multiple learning styles and multiple representations of knowledge from different conceptual and case perspectives (Kafai & Resnik, 1996). Any specific concept must be approached via a wide range of learning contexts to aim transfer of the knowledge in a broader range of domains. On the contrary, when the learning of a concept occurs as separate topics, the learning remains inert and superficial, bringing about boredom, negative effects on motivation and incapability of transfer to meaningful real-world situations (Cognition and Technology Group at Vanderbilt, 1991b). Spiro and his colleagues (Spiro & Jehng, 1990; Spiro et al., 1991a) refer to the need for 'cognitive flexibility' that stresses conceptual interrelatedness, provides multiple representations of the content and emphasizes case-based instruction that provides multiple themes. This plurality of content, strategies and perspectives typifies post-modern approaches to instruction. World Wide Web in general and Web Quests as innovative teaching strategies in particular could offer multiple representations of reality (Cey, 2001).
2.23.4 Collaborative Learning:

A central strategy for constructivism is to create a collaborative learning environment. Collaborative learning does not just entail sharing a workload or coming to a consensus but allows learners to develop, compare and understand multiple perspectives on an issue. Learners should be able to explain and justify their thinking and "openly negotiate their interpretations of and solutions to instructional tasks" (Cobb, 1994, p. 1051), leading towards the establishment of consensual meanings. The learning environment should make it possible for students to build their theories and articulate these theories to one another. By continually negotiating the meaning of observations, data, hypotheses and so forth, the learners construct systems that are largely consistent with one another (Cognition and Technology Group at Vanderbilt, 1991a). Knowledge then becomes explicit, available, generalised and promotes insight into alternative perspectives.

2.24 Roadmap for E-Learning:

Vision for the future

Knowledge-based economies, such as those dependent on hi-tech sectors such as computing, telecommunications and biotechnology, require a highly flexible and adaptable workforce that can continually change as the world changes around them. Students need to learn how to use technology to seek, organize, analyze and apply information appropriately in

a knowledge based economy. Thus the new knowledge based industries require not only technology-skilled workers with up-to-date and recent knowledge, but also workers who are constantly learning, in order for such companies to compete effectively. These changes in the workforce and the demand for more flexibility from students and employers directly influence the kind of learning and hence the kind of teaching now increasingly in demand from both students and employers in knowledge-based economies. Two important skills required to meet the requirements of knowledge economy are: Thinking skills: Problem-solving, critical / logical / numerical thinking; Knowledge navigation: where to get / how to process / how to apply knowledge.

As suggested by de la Harpe (2001), 21st century learning will happen in many different ways, and sustainable economies will have to embrace sustainable education, that is, knowledge that is continuously updated. The learning needs of individuals and societies will have to be met in new ways to further the idea of the knowledge society through investing in people and skills, at both national and global levels. Educational systems are expected to become more responsive to the new demands of the economy and of the society and more flexible to react quickly to these demands, which tend to be unforeseeable and increasingly diversified. The building blocks of the knowledge economy are creativity, and the ability to think outside the box. The new learner is self-directed. Learners are users and they need to be responsible for their own learning and to select what they use. Students have to experiment, explore and think differently to come up with a solution to a problem – to create

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new knowledge. We need to think, learn, find what works, be critical and evaluative and make something new.

Quality education for all will be our biggest challenge and also our greatest hope. Universal access to education will allow our people to participate more effectively in an interactive world. The convergence of e-learning and knowledge management will be evident in worldwide initiatives that will foster a constructive, open, dynamic, interconnected, distributed, adaptive, user friendly and accessible wealth of knowledge.

Recent surveys have found project-based learning to be one of the most enjoyable means of learning. Project-based learning is an approach which parents have been found to agree as an extremely effective way for their child to learn (Moyer, 2001). One of the most important features of project-based learning is the change from knowing to doing. Teachers and students develop new content and learning objects while learning and using digital content developed by others. 'New digital, computational-based tools' not only enable students and teachers to grapple with content in a way they simply could not do before, but they shift 'content from a series of static words and video that were given to them by someone else to something that is altogether new' (Trotter, 1999).
2.25 Summary of Literature Review

National curriculum framework 2005 proposed by National Council of Education Research and Training (N.C.E.R.T.), Govt. of India reviewed National Curriculum Framework For School Education (NCFSE) – 2000 in the light of the report, 'Learning without Burden' (1993). A national steering committee, chaired by Prof. Yashpal, suggested systematic reforms to reduce the burden and stress on students. National Curriculum Framework (NCF) also proposed the following guiding principles for curriculum development which are considered as the guidelines in this research work: a) Connecting knowledge to life outside the school, b) Ensuring that learning shifts away from rote methods c) enriching the curriculum so that it goes beyond text books d) making examination more flexible and integrates with classroom life.

Educational Initiatives (EI), which have been formed with a mission to work towards qualitative improvement in India’s educational system have conducted a national survey of over 32,000 students in 142 leading schools of five metros. Their findings reveal that students appear to be learning without understanding and that they are not focusing on real knowledge. The students are not able to apply what they learnt to real life situations. So, it is felt that there is a need to initiate reforms in curriculum, assessment, teaching and learning.

Learning and knowledge are so closely related that we can understand the process of knowledge dissemination only by understanding the relationship between learning and

* National Curriculum Framework 2005

National Council of Educational Research and Training, Published by the Publication Department by the Secretary, National Council of Educational Research and Training, Sri Aurobindo Marg, New Delhi 110 016, http://ncert.nic.in/sites/publication/schoolcurriculum/NCFR%202005/contents2.htm
knowledge. Learning leads to knowledge, which is considered as an organized combination of ideas, rules, procedures and information. Knowledge is available to support and inform decisions, behavior and actions and the feedback from the actions, in turn may generate further information, which form the basis for further learning. Sharing of networked information and knowledge enriches the knowledge capital through its diversity. The more information and knowledge are available through global networks, the more varied are the paths and opportunities for knowledge creation.

Knowledge exchange, knowledge transfer and cross-fertilization of ideas improved through global networks with extended reach increase the effectiveness in dissemination of knowledge. Global networks of the digital age create fluid multi-faceted spaces for learning, which can re-enforce and enhance knowledge dissemination, through the creation of an enriched platform for discourse – an important element of knowledge dissemination. The knowledge-based economy will be a hierarchy of networks driven by constant change in technologies and skills that create value. The digital revolution has intensified the move towards knowledge codification and sharing of knowledge through networks that provide access to an emerging, universally accessible digital library.

Education will be the centre of the knowledge-based economy, and learning will be the tool of individual and organisational advancement. This process of learning is more than just acquiring formal education and the ability to apply the knowledge to real world tasks is very important. A fundamental aspect of learning is the transformation of tacit into codified knowledge and the movement, back to practice where new kinds of tacit knowledge are developed. Networks, where interactive learning involving learners in experimentation and exchange of information is the driver of innovation.
Review of literature on learning including learning theories and concepts suggest that no particular theory or model is suitable for all situations as each of them contribute to understanding certain limited aspects of learning. Integrating the learning principles from different perspectives however can identify the attributes of an effective learning environment. Principles underlying Cognitive, constructive, experiential and motivational learning theories can be embedded in a technology enabled networked learning environment through an appropriate content design and delivery.

Cognitive load theory provides instructional designing principles for structuring information, which facilitates building knowledge in long-term memory. Modifying the instructional materials to engineer a lower level of extraneous cognitive load will facilitate learning if the resulting total cognitive load falls to a level that is within the bounds of mental resources. Content design and sequencing that graduates from simple to increased levels of complexity may alter intrinsic cognitive load and reduce extraneous cognitive load. Interactive components like applets help the student to actively interact and involve in the process of understanding which stimulates schema construction of concepts and thereby increase germane cognitive load. Cognitive development results from a dialectical process whereby a child learns through problem-solving experiences shared with someone else, usually a parent or trainer but sometimes a sibling or peer. Since students learn much through interaction, curricula should be designed to emphasize interaction between learners and learning tasks. The learning environment should be simple, interactive and learner centric.

Constructivist learning environments are learner centric and facilitate knowledge construction in individual contexts through social negotiation, collaboration and experience with due consideration for previous knowledge constructions, beliefs and attitudes of the
learner. Teachers play the role of guide, tutor, coach and facilitator by creating an environment with tools and activities that encourage meta cognition, self analysis, regulation, reflection and awareness. Self directed learning through inquiry, exploration and problem solving promotes higher order thinking and deep understanding. Collaborative learning with appreciation for multiple perspectives and alternate view points promotes understanding of conceptual interrelatedness required in multidisciplinary learning to work on projects related to real world context. So the learning environment should be learner centric, interactive and collaborative.

Theories of neuroscience, brain based learning and multiple intelligences suggest that learning environment should be learner centric to accommodate different learning styles and preferences with emphasis on learner’s social context. The emphasis should be on whole ideas, real life experiences and solving real world problems. The environment should be learner centric and motivating.

Experiential learning theory suggests that the learning environment should promote active participation of student in the learning process and has control over its nature and direction and should be based on practical, social, real life situations. This theory also emphasizes the importance of learning to learn and openness to change. Self-evaluation is recommended for assessing progress or success and shall be integrated with the learning process. Experiential learning is participative, interactive and applied. Interactive multimedia supported by innovations in technology has given way to rich interactive applications where the learner is relatively free to explore at her own pace and pursue thought in a free and non-linear fashion. So experiential learning theory and Kolb’s learning styles model suggests a learner centric and interactive environment with lot of scope for learning by doing.
Motivational learning theories suggest that motivation and learning strategies are the most important factors that influence the performance of students in achieving their goals. Motivation is a goal-directed behavior instigated and sustained by expectations concerning the anticipated outcomes of actions and self-efficacy for performing these actions. The learning environment should accommodate strategies to create and sustain attention, relevance, confidence and satisfaction. The four motivational factors that influence learning in technology enabled learning environments are: interest in or attention to the media rich, interactive content; perceived relevance of the content; self-confidence in the ability to access and use the content and resulting satisfaction from successful access and usefulness. The teachers have to understand and make use of learners' diverse learning styles in order to motivate them effectively. They should be inspired through activities that capture their imagination. The motivational aspects must be consciously designed into the web-based instruction as rigorous as any other pedagogical dimensions. So learning environment should be motivating with the associated features that contribute to motivation such as interactivity, collaboration and learner centric approach. Communities of practice and the theory that learning depends on social context associated with membership of a group suggest that collaborative learning facilitated by a networked learning environment is motivating and effective.

The learning environment could be engaging and effective if instruction design is appropriate to the learner, the context and the content with right mix of instructional strategies that can optimize the learnability of the content. The content design shall be learner centric and yet flexible to meet the requirements of a wider audience, which will be achieved through simple, shareable learning objects. The content so developed shall be anchored to establish learning theories and instructional design methodology. Innovation and creativity are required
to design and develop a learning environment that offers highly satisfying learning experiences with concepts explained in graphics-rich format with relevant applications and interactivity.

Simple, motivating, interactive, learner-centric and collaborative environment integrates the learning principles to facilitate active learning, learning with understanding and learning how to learn. Learning with understanding achieved through a shared, simple, motivating, interactive and learner centric environment helps students apply their knowledge to real world tasks and motivate them towards life long learning as they enjoy learning and learn how to learn. We need to evolve a strategy to overcome the limitation of resources in terms of enriching content, access to content, trained teachers and prepare ourselves to meet the ever changing, increasingly diversified requirements of the knowledge economy. The strategy should create SMILE and share it by extending the access to every student in a collaborative-networked environment.

Table 2.1 puts in a nutshell the various theories of learning and provides an integrated picture.
Table 2.1: Integration of learning theories in the learning environment

<table>
<thead>
<tr>
<th>Principles of learning theory</th>
<th>Application of learning principles</th>
<th>Attributes of learning environment</th>
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</thead>
<tbody>
<tr>
<td>Cognitive perspective:</td>
<td>Structuring, organizing and</td>
<td>Simple, Motivating, Interactive</td>
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<td></td>
<td>sequencing information to</td>
<td>and Learner centric:</td>
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<td></td>
<td>facilitate optimal processing:</td>
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<td></td>
<td>Content structuring and</td>
<td>Emphasis on explanations,</td>
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<td></td>
<td>sequencing to move from</td>
<td>examples, analogies, practice</td>
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<td></td>
<td>simple to increased levels of</td>
<td>demonstrations and feedback.</td>
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<td></td>
<td>complexity.</td>
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<td></td>
<td>Use strategies like advance</td>
<td>Cognitive strategies like</td>
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<tr>
<td></td>
<td>organizers, analogies,</td>
<td>outlining, summaries, advance</td>
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<td></td>
<td>hierarchical relationships and</td>
<td>organizers. Images and</td>
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<td></td>
<td>matrices. Arrange practice</td>
<td>pictures centered around a</td>
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<td></td>
<td>and feedback so that new</td>
<td>theme along with animations to</td>
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<td>information is assimilated or</td>
<td>explain concepts.</td>
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<td></td>
<td>accommodated.</td>
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<td></td>
<td>Encourage link to existing</td>
<td>Explain the subject matter</td>
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<td></td>
<td>knowledge, recall prerequisite</td>
<td>through simple concepts and</td>
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<td></td>
<td>skills and use examples,</td>
<td>interesting facts related to</td>
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<td></td>
<td>analogies to enable learners</td>
<td>social context of the learner.</td>
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<td></td>
<td>understand how to apply</td>
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<td></td>
<td>knowledge in different contexts.</td>
<td>Instructional techniques such as</td>
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<td>Split attention effect,</td>
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<td>Modality effect, redundancy</td>
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<td></td>
<td>Micro strategies for content</td>
<td>effect. Worked example effect</td>
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<td></td>
<td>presentation</td>
<td>reduce cognitive load.</td>
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<tr>
<td>Motivational theory:</td>
<td>Kolb’s ARCS model:</td>
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<td></td>
<td>Attention: Students must be</td>
<td>Simple, Motivating and</td>
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<td>attentive to the learning</td>
<td>Interactive: Multimedia</td>
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<td>environment and remain so</td>
<td>presentations, which make</td>
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<td>throughout the experience.</td>
<td>learning interesting and motivating.</td>
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<td>Relevance: Present content in</td>
<td>Explaining the concepts with</td>
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<td>ways that are related to the</td>
<td>simple, interesting facts,</td>
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<td>learners’ experience and values.</td>
<td>analogies and stories relevant to</td>
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<td>the world around us and their</td>
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<td>application in real life situations.</td>
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<tr>
<td>Increases leading to increased motivation. Instrumentality (award for their performance) and valance (value or attractiveness of the reward) also need to increase in order for the motivation to increase.</td>
<td>Confidence: Provide challenging and meaningful opportunities for successful learning by organizing materials in order of increasing difficulty and attributing success to effort. Satisfaction: Positive reinforcement and motivational feedback.</td>
<td>Presentation of ideas and concepts in a way that is simple and easy to understand through interactive simulations. Online quizzes with worked out examples and solutions improve confidence and satisfaction.</td>
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<tr>
<td><strong>Experiential learning:</strong> Learning is the process whereby knowledge is created through the transformation of experience.</td>
<td><strong>Accommodate varied learning styles:</strong> Educators must place emphasis on interactive simulations, projects, role-play and case studies structured to include understanding of the situation. Learners are engaged in activities that simulate or mirror what they would in the real world. Assign a practical problem and ask participants to use &quot;active application&quot; in trying to solve the problem. Flexibility in curriculum and assessment to accommodate varied learning styles and achieve learner control. Facilitate participants to gain a deeper understanding of a problem by researching, investigating and exploring relationships.</td>
<td><strong>Interactive and Learner-centric:</strong> Challenging assignments, problems and games that simulate applications in real life, which make learning interesting while being relevant and meaningful. Interactive applets and animations to explain difficult concepts. Simulations of experiments difficult to perform in lab such as polarization, total internal reflection and interference. Self-evaluation is the principal method of assessing progress. Quizzes along with worked out solutions that enable learners to assess their own understanding. Authentic projects that elicit research, exploration and team work with sharing of multiple perspectives, reflection and synthesis of different concepts into whole ideas.</td>
</tr>
</tbody>
</table>
### Brain based Learning:

Each brain is unique and the search for meaning comes through pattern. We understand best when facts are embedded in natural, spatial memory. Personally meaningful challenges stimulate participant's mind to the desired state of alertness. Active processing of experience helps learners to gain insight about a problem. There are many forms of intelligence. We learn, communicate and solve problems in at least seven ways.

### Constructivism:

Learning is a process where in, the learner actively constructs new ideas or concepts based on his current and past experiences.

Constructivism proposes that knowledge is derived by each individual through their personal interaction with their environment.

Learning is creating meaning from experience. Learning occurs in realistic settings and selected tasks relevant to the student's experience. Learning must include activity, concept and culture.

Learning is an active process in which conceptual growth comes from the negotiation of meaning, the sharing of multiple perspectives and the changing of our internal representations through collaborative learning.

### Orchestrated immersion

- Creating learning environments that fully immerse participants in an educational experience.
- Relaxed alertness - Trying to eliminate fear in learners, while maintaining a highly challenging environment.
- Active processing - Allowing the learner to consolidate and internalize information by actively processing.
- Balanced curriculum that incorporates and appeal to all the intelligences. Assessment methods that take into account the diversity of intelligences and help participants understand their intelligences.

### Creating learning environments

- Promote a student's free exploration within a given framework or structure.
- Encourages students to discover principles for themselves and to construct knowledge by working to solve realistic problems.
- Learning should be situated in realistic settings and testing should be integrated with the task instead of being a separate activity.
- Sharing of knowledge with others while doing projects helps learners to create novel and situation - specific understandings by assembling prior knowledge from diverse sources appropriate to the problem at hand.

### Motivating, interactive and learner centric:

- Immerse participants in interactive experiences that are both rich and real.
- Challenging assignments such as projects, which are authentic and requires exploration and research.
- Role playing, cooperative learning, story telling and practical work.
- Flexibility in curriculum and assessment to accommodate diversity of intelligences. The environment should be customizable and creative enough to find new ways of teaching the subject to develop the multiple and varied intelligences of learners.

### Anchoring learning in meaningful contexts:

- Online learning offers flexibility in learning to students and provides access to varied but accredited content through educational portals and other online sources.
- Presenting information in variety of ways [cognitive flexibility]. Align and design experiences for the learner so that authentic, relevant contexts can be experienced through cognitive apprenticeship, collaborative learning and social negotiation.
- Self-assessment and continuous feedback on various aspects.
- Project based learning in a collaborative environment, which encourages multiple perspectives, authentic activities and real-world environments.