Chapter 1
The New Shape of Learning: Adapting to Social Changes in the Information Society

Ronghuai Huang, Geng Chen, Junfeng Yang and John Loewen

Abstract   Changes in the way we communicate in the age of social informatization has affected the way we live, work, and consequently, the traditional ways in which we learn. This transformation requires a new way of thinking about learning. The essential difference between learning in a traditional manner, called **nibbled learning,** and information-based learning, also called connected learning, lies in the different understandings of knowledge processing. Nibbled learning is the process by which the learners pass required tests according to standard requirements and a set order of knowledge units so as to comprehensively master the learning contents within a specified period of time. Connected learning, with the characteristics of autonomy, enquiry, and collaboration, has been widely piloted and adopted in informal learning and training. In order to understand and promote connected learning, we define a learning scenario as "a comprehensive description of one or a series of learning events or learning activities", which includes four elements: learning time, learning place, learning peers and learning activities. Five typical types of learning scenario are defined; classroom lectures, individual learning, inquiry learning, learning by doing, and work-based learning. The concept of an effective learning activity is introduced followed by a description of the five conditions that make up an effective learning activity; to start with authentic

R. Huang (✉)
R&D Center for Knowledge Engineering, Beijing Normal University, Beijing 100875, China
e-mail: huangrh@bnu.edu.cn

G. Chen
Beijing Jiaotong University, Beijing 100088, China

J. Yang
Hangzhou Normal University, Hangzhou 310038, China

J. Loewen
Vancouver Island University, 900 5th Street, Nanaimo, BC, V9R 5S5, Canada

problems, to motivate with learning interests, to take the experience of learning activities as the explicit behaviors, critical thinking as the implicit behaviors, and tutoring and feedback as external support. A proposal is put forward that the five laws of technology enhanced learning (TEL), namely digital learning resources, virtual learning communities, learning management systems, designer psychology and learner psychology, must be met in order to carry out effective learning activities and make use of technologies to enhance learning demands. Lastly, the process of transformation of main-stream digital learning resources (such as the modes of individual task, micro courseware, hand-on processes, group coordination and similar experiences) from nibbled learning to connected learning is discussed.

Keywords Learning scenario · Learning activity · Effective learning · Technology-enhanced learning · Five laws of TEL · Social informatization · Nibbled learning · Connected learning · Digital resource form

1.1 The Need to Reshape Learning to Reflect Social Changes in Today's Information Society

The phrase "social informatization", a well-known Chinese academic construct, is relatively unknown in Western academia. One of the few references in western academia is provided by Kim and Nolan (2006) who state that "'social informatization' can be defined as the process by which the social capacity to generate, process, and transmit information increases". From a Chinese academic perspective Qi (2003), identifies that social informatization is the process by which the focus of national economic and social structures transfers from a physical space to an informational or knowledge space). In more detail, social informatization is the process by which computer information processing technology and transmission means are widely used in all sectors of society. Consequently, social interactions and methods of doing business have dramatically changed.

Social informatization is caused by the rapid development of information and communication technology. The information technology revolution, mainly represented by computers, microelectronics and communication technology is the driving source of social informatization (Shi and Lin 2009). Modern information technology with digital technology as the basic feature represents and stores the real world in the form of digital symbols and then uses computing technology to do the high-speed processing and transmission. Modern communication technology transmits digital symbols in the forms of electrical signals and optical signals at speeds faster than the human mind can register. With the spread of modern information and communication technology to all corners of the world and all aspects of people's work and life, a digital world modeled on the real world will rapidly expand. The digital world is a combination of the real world and virtual

world. Therefore, to a certain extent, social informatization is the gradual coupling process of the digital world and the real world.

With the rapid development of the digital world and its gradual coupling with the real world, social informatization highlights two basic characteristics; the rapid growth of information and the accelerated pace of life. The rapid growth of information (commonly known as "information explosion") refers to the huge amounts of digital information that is accessible. The channels of access to this information are gradually increasing allowing for quicker access to information as well as access to information that was previously inaccessible. This exponential growth in information accessibility is what has led to the term "information explosion". Consequently, it takes much less time for people to access information, so at work, people "seem" to be more efficient. Conversely, a variety of irrelevant information is pushed to these same people. Social informatization makes people aware of the convenience of accessing information, but in the face of a large volume of information, individuals will also feel overwhelmed and frustrated due to the abundance of irrelevant information.

Social informatization has brought great changes to people's life styles. These changes are mainly reflected in the ways of communication, commerce and leisure. In the way of communication, traditional mail correspondence is gradually being replaced by e-mail, fixed telephone by mobile phones and face-to-face conversation by real-time online communication tools. In the way of commerce, with the growing popularity of electronic bank cards, online payments will become the main way of payment for the next generation and virtual currency will become an important part of the currency system. As more and more online stores become available, physical stores will have to combine with virtual stores in order to compete. In the aspect of leisure activities, paper reading will be partially replaced by "electronic paper reading", the increasing number of television channels will be gradually integrated with online videos. Additionally online games will become an important way of leisure for the younger generation and online dating will become an important component of socialization for young people.

Social informatization will change the way of working for many people, thereby promoting the development of newly emerging industries, particularly in the service and creative industries. The most important feature of the information age is the increased proportion of service industries and a decreased proportion of manufacturing industries. This increase of service industries, which are replacing traditional industries in every sector are supported by informatization. Creative industry is a major force in the modern service industry. Creative industry includes online videos, online games and so on. The basic philosophy of this creative industry is to provide on-demand and personalized service. The main ways of working in this new creative industry are working at home, online collaborative working and individual and small-group work.

Social informatization will change people's perspectives on their capability, knowledge and learning; because of this, the traditional way of learning will face great challenges. The new perspective of capability focuses more on the capabilities of learning, collaboration and information processing. The new perspective

of knowledge is no longer limited to just knowing "what" and "why", but focuses more on knowing "where" and "how". The phrase "knowledge is power" will have a new meaning. The sources of knowledge will be expanded; the role of knowledge from books will become increasingly limited, while the role of personal experience or tacit knowledge from work and life will become more prominent. Our understanding of learning philosophy will change. As the boundary between learning and work becomes increasingly blurred, academic education prior to work will no longer be the norm and the acquisition of different diplomas on the same level at different phases of life will gradually become a reality. The new way of learning is that of informatization, with inseparable relations to information and communication technology. As one of the survival skills in the information society, the informatization way of learning has drawn more and more attention. The way of learning that simply "digests" the knowledge from books will become a way of the past. Experiential learning, with participation in activities and problem solving in groups, combined with the virtual world will gradually become the mainstream way of learning. With this transition from the old way of learning to a new learning mode, it is then important to define the characteristics of this new learning mode so that it may be used effectively to leverage the advances of the new information society.

1.2 Connected Learning: Matching Learning with Social Change

Information technology has brought many possibilities to learning in the new era. Where information technology reaches, many new learning modes emerge with a common characteristic, which is to make full use of the function of technology to accomplish learning outcomes that many not be realized in traditional learning (Li and Chen 2006/2011).

1.2.1 Transitioning from Traditional Learning to Connected Learning

A new learning method, informatization learning mode is presented as a way to fully apply and use information technology and digital resources in learning. Informatization mode refers to enriched learning experiences that are created with effective use of appropriate technologies and digital resources. If the learning process is interpreted as the process of learners' processing knowledge, the most fundamental difference between informatization learning mode and the traditional learning mode lies in the different understandings of people on how to process knowledge in one mode versus the other mode.

The traditional learning mode is mainly based on "nibbled learning" Nibbled learning is the process by which the learners pass required tests according to standard requirements and a set order of knowledge units so as to comprehensively master the learning contents within a specified period of time. In nibbled learning, the learning paths of the learners are homogeneous and linear and learning methods are single and relatively rigid which is not conducive to the fostering of innovative thinking. Long affected by the nibbled learning mode, the traditional learning mode follows three different models: teacher-centered, textbook-centered and classroom-centered. The learning contents are relatively closed and many textbooks seem to present a "maze" of knowledge, which is carefully designed according to the theoretical structures and whose framework is usually composed of outdated knowledge. Questions and answers in this model emphasize memorization. Classroom teaching seems only to help students become familiar with the maze, answering questions on the structure of the maze, providing students with knowledge on how to answer the questions about the maze, and finally giving exams to test student's knowledge about the maze. In nibbled learning, although students try hard to understand and master all the knowledge to be learned, they are used to matching the questions to the answers, "looking for" the answers in the books and "asking for" the answers from their teachers. In this sense, it seems to be a process of training students on "how to look for the answers" and how to "memorize the answers" without thoroughly thinking and analyzing the contexts of the issues; this is superficial learning.

Knowledge connected learning is proposed as being included as an integral attribute of informatization learning mode. Knowledge connected learning is the process by which the learners start from the understanding of knowledge sources and knowledge structures of the same learning objectives and gradually master within the key knowledge contents so as to master the whole learnt knowledge within the specified period of time. In connected learning, the learning paths of the learners are differentiated with both linear and non-linear paths. Flexible learning methods are more conducive to the fostering of innovative thinking and reasoning.

1.2.2 The Characteristics of Connected Learning

Knowledge connected learning is generated from the requirements of social informatization, accompanied by the changes in people's lifestyles. In traditional textbooks, the learning contents focus more on:

- the individual knowledge unit than the connection between the knowledge units;
- the knowledge in the books than the connection between the knowledge in the books and the real world; and,
- how to match the questions to the answers than the identification of the contexts of the problem and the definition of the problem.

While in the informatization learning mode, the learning content is no longer confined to the knowledge mazes in traditional textbooks, as these knowledge mazes do not work. The learning process is no longer one of matching questions and answers, but one that focuses on how to understand the problem context, how to define the problem, how to ask questions and where to find a solution to the problem and so on. Informatization learning mode has the following characteristics:

(1) One of the basic objectives of knowledge-connected learning is to develop the capability of knowledge transferability and the formation of good study habits. Knowledge transferability is an important foundation for lifelong learning, which includes the capabilities of knowledge transferability, learning with the use of technology, collaboration, information processing and so on. An important feature of the cultivation of lifelong learning capability is to foster good study habits from a young age.

(2) A problem-oriented approach is the starting point of knowledge-connected learning. Without questions, there will be no thinking and therefore no connection with knowledge, making it difficult to have deep learning.
    In the traditional nibbled learning method, learners read the materials provided and listen to the teacher. The four basic steps for the learner are to preview the textbook, listen carefully to the teacher, review the materials, and to consolidate the learning by completing homework. These steps are completed in an iterative way. All the steps are based on the materials with the objective being to digest the materials provided, and the assessment of the course is to test the extent to which the student has "mastered" the materials content. Knowledge connected learning does not necessarily start from previewing materials; it may start from a problem or task. In today's society, it is difficult for the students to stay focused on the lectures provided by the teacher. Professor Naomi Baron explains that students have a very short attention span in part because of "the media that we as teachers and parents have encouraged them to spend their time with, and in part because we haven't taught them to have longer attention spans" (quoted in Carlson 2005). When giving lectures, the teacher has to change their teaching methods approximately every 15 min to "humorously" attract students' attention by changing the topic. This fact shows that nibbled learning is not suited to the student that is present in today's classroom.

(3) Open classroom is a prerequisite for connected learning.
    Connected learning will expand teaching scenarios in an open classroom model. The single form of classroom teaching (the closed model) is not suitable for the requirements of today's students. With the open classroom model, individual learning with clear tasks, collaborative learning in groups with a common goal, experiential learning oriented with complicated activities and processes, and problem-based learning oriented with practical situations will become more widely used.

(4) The effective use of information technology is important for connected learning.

The personal computer, handheld devices and e-readers will become the essential equipment of students. Information technology is not only a learning support tool, but also a cognitive tool. How to use information technology in learning will become an important indicator of measuring whether students are "capable".

(5) Social interaction is an integral part of connected learning.

The interaction between teachers and students is no longer the only method of interaction. Firstly, the interaction among students from the same school as well as from different schools, have become more and more important. This interaction is facilitated by modern communication technology. Secondly, learning through interactive media will take up a larger proportion of learning. Effective human–computer interaction (HCI) will enhance learning effectiveness and efficiency. Zhang and Nunamaker (2003) observes that HCI research facilitates the design of easy-to-use interfaces that precisely present learning materials in a large variety of formats. Finally, the teacher is no longer the sole knowledge "owner". Due to the easy accessibility of information, students often know more than the teacher, so the knowledge contribution provided by the students in the teaching process is indispensable.

1.2.3 Teaching Methodology Changes Required by Connected Learning

In face of the requirements of informatization learning mode, the traditional "indoctrination" teaching mode will face huge challenges. Firstly, it is difficult for the teacher who's only experience is that of "digesting" textbook knowledge to imagine what form connected learning should be. This type of teacher will usually think that as long as they are provided with good teaching materials and resources of "high quality", students will carefully "digest" these materials. Secondly, it is difficult for teachers who are used to classroom lecturing to figure out an "interpretation" on how to organize learning activities as they usually think that as long as they provide "excellent" recorded lectures, the students will carefully "watch" them.

The teachers who do not have practical experience and who do not pursue professional development in a multi-disciplinary fashion will find their knowledge and skills insufficient to meet the demands of today's students. Finally, teachers born prior to the 1980 s are called "digital immigrants" whereas current students are called "digital natives" (Prensky 2001). The information literacy of digital immigrants is far behind that of "digital natives" which will make teaching for digital immigrants a more difficult process.

The transformation from nibbled learning to connected learning is an innovative process. The creative process will be reflected in the following aspects.

1.2.4 Preparation: From Preparing Lessons to Designing Learning Activities

The process of preparing lessons refers to all preparatory work that needs to be completed by teachers in order to deliver a teaching task. Teachers form teaching capability based on the requirements of teaching, which is an important part of the whole process of teaching and an important step for giving a good lesson. Lesson preparation has three levels of focus: a semester, a unit and a lesson. When preparing lessons, teachers have to become familiar with the syllabus and materials in order to grasp the teaching contents, to analyze the teaching tasks and to clarify the teaching objectives, to study the characteristics of the student and choose appropriate teaching methods, to design the teaching process and write lesson plans so as to prepare for class. The "three preparations" of the traditional lesson preparation in nibbled learning refer to preparing teaching materials, preparing students and preparing teaching methods. Preparing teaching materials requires the teacher to fully understand the teaching contents, preparing students requires the teacher to understand the students' mastery of associated knowledge, and preparing teaching methods requires teachers to think about how to allocate time in class and how to give effective lectures. In China, with the implementation of new curriculum reform in basic education, the contents of lesson preparation have extended from a "three preparation" method to a "five preparation" method, consisting of preparing curriculum standards, preparing teaching materials, preparing teaching methods, preparing the students and preparing the expected outcomes. Preparing curriculum standards requires teachers to think about how to implement the guidelines of the new curriculum reform and preparing the expected outcomes requires teachers to reasonably preset learning outcomes in order to flexibly respond to the changes in class. This is a big step in moving towards connected learning.

The key feature of connected learning is that it is a student-centered perspective, with one of the core indicators being to design a learning activity system based on the learning process of students. The main focus of teachers' lesson preparation is on how to design learning activities that connect possible learning outcomes with the teaching objectives, how to give consideration to both the individuality and commonality of students, how to effectively organize learning activities and how to design evaluation and so on. Giving a lecture is only one type of learning activity and therefore is only one part of the process.

1.2.5 Process: From Lecturing to Organizing Learning Activities

The focus of nibbled learning is lecturing, specifically how to give a good lecture. The issues discussed in the class in K-12 schools, such as how to lead in a new

lecture, how to guide students to think, how to give a summary of the lecture and how to maintain classroom discipline and so on are all about how to give a lecture. The classroom lectures are only one part of connected learning with a very limited range of application. Individual learning, collaborative learning in groups, experiential learning and problem solving learning, are more focused on how to effectively organize activities. The effective organization of learning activities require teachers to learn more about individual students, to prepare more resources to meet the requirements of different students and to provide different kinds of evaluation methods, all of which are enormous challenges for the teachers who are used to only giving lectures. Therefore, the new learning mode requires teachers to shift their teaching focus from lecturing to organizing learning activities.

1.2.6 Evaluation: From Examinations to the Entire Learning Process

As an important part of the teaching process, evaluation is synonymous with examining the students' learning achievements, which in the traditional sense refers to academic scores which are the results of the examination. The contents of the exam are usually variants of the example exercises in the textbooks that students can remember, explain or complete such as multiple choice, fill in the blanks, definition, short answers, and comprehension questions, which only reflect "shallow learning" situations of the students. Following the traditional learning process means adding a mid-term exam and unit tests to the final exam to come up with a grade. In order to distinguish from "examination-oriented education", the hundred-point scale system of exam scores is changed to a five-point scale; this does not change the essence of the process. The evaluation of connected learning changes the understanding of learning achievements right from the beginning. Learning achievements are no longer the reflection of "superficial learning" situations, but of the reflection of "deep learning", shifting from what students have remembered, what they can explain, what they can complete of the example exercises in the textbooks, to situations where the focus is on what students have thought about, what they have experienced and whether they can ask questions and solve problems. Obviously, "deep learning" cannot be "examined" by the traditional examination method.

1.2.7 Services: From Monitoring to Providing Support for the Learning Process

The purpose of nibbled teaching mode is to train the students to navigate in a closed maze of knowledge; teaching focuses on helping students become familiar

with the maze of knowledge and exams are given to evaluate student's familiarity with the maze. Another important part of this teaching process, Q&A, seems to provide advice in order to aid students' navigation. Connected learning:

- removes the learning contents from the restriction of the maze allowing a change from organizing teaching to organizing learning activities so that students' learning becomes "self-constructed";
- evaluates the process of the students ability to think, experience, and solve problems;
- changes the "Q&A" from helping students to find answers in the maze to support their learning and covers the process of guiding students to ask questions, define concepts and seek answers for problem-solving strategies.

In order to improve the teaching methods and then to foster and improve connected learning, it is necessary to identify when, where and how learning occurs.

1.3 The Learning Scenario: Identifying When, Where and How Learning Occurs

1.3.1 The Meaning of Learning from Different Perspectives

"Learning" is one of the most commonly used words in our work and daily life. Parents often tell their children to be good at "learning", as do the employers to their employees, and even the teachers to their students. However, the word "learning" does not have the exact same meaning in the above contexts, indicating that individual people may have quite different understandings of the word "learning".

What is learning? That is one of the fundamental issues in the research of learning theory. Learning theory is a branch of education and educational psychology, which describes and illustrates the learning categories, processes and learning conditions of humans and animals. Some people think that learning theory includes three types of philosophical frameworks; behaviorism, cognitivism and constructivism (Woolfolk et al. 2006). Alternatively, some people believe that cognitive learning theory includes constructivist learning theory and that humanism is the third most popular learning theory thus, the three types of learning theory should be behaviorism, cognitivism and humanism.

The representative of early behaviorism, Edward Lee Thorndike believes that learning is formed by the link of the stimulus and response in the nervous system, which is the basic theory on learning in behavioral psychology. John Watson believes that learning is the link of stimulus and response through conditioned response. Therefore, behavioral learning theory considers learning as the establishment of the link of stimulus and response (S–R), as the process of trial and error, with the emphasis on the behavioral change caused by exercise driven by

reinforcement (quoted from Baum 2005). B. F. Skinner put forward the principle of operant conditioning and carried out a systematic study on the reinforcement principle, which improves the development of the theory (quoted from Slater 2004). The instructional machine and programmed instruction designed by Skinner based on the principle of operant conditioning used to be very popular; it promotes the development of audio–visual instruction, programmed instruction, and early computer assisted instruction (CAI).

Cognitive learning theory has a different view of the essence of learning. For example, Gestalt psychology (also known as traditional cognitivism) states that memory traces are left in the brain through learning and stay in the nervous system after the experience. These traces are not isolated elements, but an organized whole. Edward Chace Tolman, an expert in Sign Gestalt Theory, believes that learning should be the process of moving from a sign or a signal to a certain symbolic meaning (i.e. S–S), and the acquirement of expectation rather than the formation and link of habits. Learning achieves the objectives based on the mind map (i.e. cognitive map) or on environmental signals. Jean Piaget, the founder of constructive cognitive psychology, believes that learning is a proactive self-regulation process that has different forms at different stages of the individual development process of a learner (quoted from Cole et al. 2005). Therefore, cognitive psychology emphasizes the motivation of the individual as an organism, that learning is the personal understanding and organization of the scenario; the result of internal reflection on external stimuli with the emphasis on internal strengthening.

Constructivism is based on the internal reflection of cognitive psychology. The Piaget school and the school of social and cultural history in the former Soviet Union played a crucial role in promoting the popularity of constructivism in the United States. Piaget believes that learning is a kind of "self"-construction. Lev Vygotsky believes that learning is a "social construction", emphasizing the role of the social, cultural and historical background of the learner in the cognitive process, attaching great importance to the positions of "activity" and "social interaction" in the development of an individual's high-level cognitive ability (Santrock 2004). Therefore, knowledge is not taught by teachers but acquired by learners in certain contexts or socio-cultural contexts with the help of others (including teachers and learning peers) as well as necessary learning materials (all the pieces allowing for the construction of knowledge). Constructivist learning theory is considered one of the most important theories in fields such as computers in education and e-learning, etc.

Humanistic psychology was founded by Abraham Maslow, and is represented by Carl R. Rogers, who believe that once people have a sense of security, once they are no longer hungry, all they want to do, no matter what job or level, is to learn and grow (Maslow et al. 1998) (quoted from Farber et al. 1998). The essential difference between humanism and other academic schools is that humanism places an emphasis on the positive nature and value of an individual, rather than focusing on the individual's misbehaviors. Additionally, it emphasizes the individual's growth and development, which is referred to as self-achievement.

Humanistic learning theory is considered to be the most important theoretical support for adult learning and in-service training.

So, what is "learning" for teachers, students and parents? It is difficult to give a unified explanation in the views of behaviorism, cognitivism, constructivism, or humanism. It could be said that it is a broad concept of "learning" with a varied meaning according to different contexts. It is undeniable that "learning" in daily teaching usually refers to students listening to lectures, completing self-study and participating in group discussions. It actually refers to a learning scenario, an agreement between the teachers and students on how the students should learn. Therefore, this paper intends to categorize "learning" by learning scenarios in the hope of understanding what learning is, and how to learn effectively from another perspective.

1.3.2 The Concept of a Learning Scenario

Conole and Oliver (1998) describe learning scenarios as including the following characteristics:

- media type;
- use of media;
- the preparatory work required;
- the educational interactions which are supported;
- the delivery constraints.

Edutech Wiki defines a learning scenario as an instantiation of an instructional design model for a given subject and a given kind of situation. It basically defines what learners and other actors like the teacher should/can do with a given set of resources and tools.

In this paper, we refer to a learning scenario as a comprehensive description of one or a series of learning events or learning activities, which includes four elements; learning time, learning place, learning peers and learning activities. Commonly speaking, a learning scenario refers to the time, place, people and events of a learning activity as shown in Fig. 1.1.

Firstly, a learning activity, the first element of a learning scenario refers to the combination of both the students' and teachers' tasks needed to complete a particular learning objective (Yang 2005). For learners, a learning activity refers to the issues of what to learn (or what to "do") and how to learn (or how to "do"), which is an "activity" or "activity" series. From the perspective of a teacher or designer, a complete learning activity consists of the following components: learning objectives, activities or tasks, learning methods and operational procedures, organizational forms, ways of interaction, forms of learning outcomes, activity monitoring rules, roles and responsibilities, learning evaluation rules and evaluation criteria. Learning activities should include three basic elements:

Fig. 1.1 The four elements
of a learning scenario: TAPP
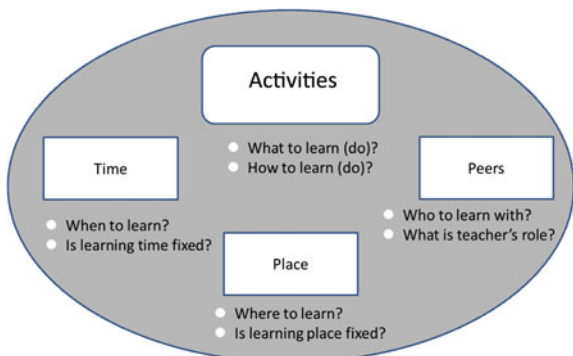
learning tasks, learning methods and evaluation requirements. In certain contexts, a learning activity and learning scenario are synonymous.

Secondly, learning place and learning time do not seem to be an important point of discussion in school education, but both are important in distance education and corporate training. For example, are learners learning in an established learning center (for online education) or training site (corporate training)? They may learn in the workplace or at home and for fixed or variable lengths of time. These issues are worthy of discussion. In fact, even in school education it may be, where the learning place is arranged in a regular classroom, multimedia classroom, laboratory, computer room or library, and learning time is scheduled on a weekday morning, afternoon or evening, or during the weekend, that conditions will lead to different forms of teaching organization, that the type of learning place and different time periods and duration, if it is fixed, involves not only the teaching arrangement, teaching organization and condition preparation, but also the psychological preparation of the learner. Different learning places and time periods have different "metaphors" to different learners, which will generate different psychological preparation.

Moreover, the concept of a learning peer does not seem a worthy issue for discussion in classroom teaching in schools or training institutions and organizations because in this form of collective learning, learning peers are the learner's classmates. In corporate training, learning peers are often strangers, so at the start of teaching, "ice-breakers" that aim to introduce participants to one another are very important. In distance learning, learners have difficulty in finding the same category of learning peers, and consequently, the loneliness and isolation of learning and being unable to seek the help of learning peers have become prominent issues. Similarly, even in conventional classroom teaching, it is common practice to separate students into smaller groups; this is a very important issue when organizing coordinated learning. Therefore, the important role of learning peers in learning activities is also an integral part of a learning scenario.

1.3.3 The Features of Five Typical Learning Scenarios

All learning should occur in a certain learning scenario. Although it is difficult to specify all learning scenarios, they can be classified by the following rules:

(1) Learning scenarios with specific learning places, learning events and learning peers are usually in the forms of classroom teaching or learning counseling represented by "classroom lectures";
(2) Those without specific learning places, learning events and learning peers are typically in the form of self-study represented by individual self-study; and,
(3) Those with at least one of the three elements unspecified can be further divided into three categories, which are represented by "group discussion", "learning by doing" and "learning in practical work".

This paper will discuss five typical learning scenarios: classroom lectures, self-study, inquiry learning (or group discussion), learning by doing and work-based learning (learning in practical work (shown in Table 1.1).

The phrase "classroom lectures" refers to learning in the classroom on campus or in similar learning environments. It is a collective learning behavior, usually in the form of classes. It has three typical features. First, it has a fixed teaching environment, like classrooms, meeting rooms, etc.; second, there are teachers to give face-to-face lectures, or organize classroom discussions and other forms of teaching; third, there are agreed or prepared learning contents, such as textbooks, handouts or outline, etc., which are often relatively fixed.

The scenario of "self-study" refers to the learning behaviors pre-appointed or arranged by the teacher, which are organized by the individual learner usually without teachers' instruction or mentoring. Although there may be learning peers around who may even play the role of teacher for one another, their own learning is usually carried out independently. The three basic features of self-study are specific learning contents, pre-set learning objectives, and specific evaluation requirements or evaluation methods. For example, exams for self-study learners take self-study as the main learning form, with homework and exercises as the evaluation methods and passing the exams organized by the host units as the evaluation requirements.

The scenario of "inquiry learning" refers to the learning form of participating in groups and communicating in discussion. Mayer (2004) defines inquiry learning as the process where students adopt a scientific approach and make their own discoveries; they generate knowledge by activating and restructuring knowledge schemata. De Jong (2006) adds that inquiry learning environments also ask students to take initiative in the learning process and can be offered in a naturally collaborative setting with realistic material. It can be a part of classroom teaching or a learning form at work, or be organized by learners themselves. A successful "inquiry learning" scenario usually consists of three features, which are clear inquiry topics, moderate scale of members and a powerful learning organizer.

Table 1.1 Five typical learning scenarios

Learning scenario	Learning activity	Learning place	Learning time	Learning peers
Classroom lecture (collective)	• F2f classroom lecturing • prepared teaching materials • Specific learning contents • Preset learning objectives • Specific evaluation requirements	Fixed teaching environment	Fixed time	Classmates
Individual learning (individual)		Not fixed	Not fixed	Not fixed
Inquiry learning (group)	Specific discussion topics	Not fixed	• relatively concentrated discussion period	• Appropriate group membership • Appropriate group leader
Learning by doing (community)	• Task-oriented evaluation • Learning support	• Activity based on the environment	• Tasks matched to the objectives	Not fixed
Work-based learning (community)	• Learning contents rooted in the work • Tasks matched to the complexity of work	• "Work" place	Not fixed	• Partners • The interpersonal relationship is suitable for learning

The scenario of "learning by doing" refers to the learning form, which embeds "doing" activities in the learning activities of school education or training. "Learning by doing" places the emphasis on learning as the experience of "doing". For example, that the youth conduct "research" by imitating the research procedure of scientists is a typical "learning by doing" scenario. In the past, learning by doing may have been difficult to implement; but technological tools, such as simulations, observation using remote instruments, field work with mobile devices as data collection platforms, and connecting with mentors and research communities enables authentic learning experiences in ubiquitous learning environments (Lombardi 2007). A successful "learning by doing" activity usually consists of four elements which are learning tasks matched with learning objectives, evaluation methods matched with learning tasks, support service matched with students and the organizational form matched with the learning environment.

The scenario of "work-based learning" is a learning form that involves gaining experience through practical work. Although it emphasizes "doing" as "learning by doing", it is based on the practical working environment and working tasks rather than in "simulating" the environment. A successful "work-based learning" activity usually has three distinct features, which are learning contents rooted in the work, learning tasks matched with the working intensity, and interpersonal relationships or a learning atmosphere suitable for learning.

The five learning scenarios have their own advantages, disadvantages and impact conditions, as shown in Table 1.2.

(1) "Classroom lecture" is considered to be a common learning scenario. Most parents consider it as the most important way of learning, and it is the best way of learning when attending a class instructed by a famous teacher or a senior-class teacher. It is not difficult to organize lectures for the teaching organizers, who just have to invite a good teacher and arrange the classroom for facilitation. Neither is it for learners, because whether they are listening to the classroom lectures depends on their moods at that time and the degree of acceptability. However, listening to the classroom lectures mainly uses memory. There is often lack of communications in larger classes. The effectiveness of classroom lectures depends on the teaching skills of teachers and the existing knowledge of students as well as their interest in the contents.

(2) "Individual learning" is considered as the most flexible learning scenario, with flexible time and place, which has the added advantage of time conservation. The disadvantage is that the learners may feel lonely and may be unwilling to get help in the face of difficulty. Its impact conditions are the readability of learning materials, and the degree of linkage of learning contents to the learners' knowledge background. In addition, personal learning interest also plays a crucial role.

(3) "Inquiry learning" or "group learning" is commonly used but not often considered as a "learning" scenario. The advantages are that the participants easily generate interest and there are usually more opportunities for communications and exchanges in small-scale discussions. The disadvantages are as

Table 1.2 Basic features of the five learning scenarios

Learning scenarios	Advantages	Disadvantages	Impact conditions
Classroom lectures (collective)	• Easy to organize • "Feel" easy	• Mainly learn by memory • Fewer opportunities for communication	• Teachers' lecturing skills • Learners' interest in the contents
Individual learning (individual)	• Flexible time and place • Usually save time	• Easy to feel lonely • Difficult to get help	• The readability of materials • Personal interest in learning
Inquiry learning (group)	• Easy to generate interest • More opportunities for communication	• Spend more time • Easy to "rely on the work of others"	• Group leader's organizational capacity • Good interpersonal relationships
Learning by doing (community)	• Easy to generate interest • Good learning effects	• Difficult to get help • May not pass the "exam"	• The design of tasks • Support service for learning
Work-based learning (team)	• Learning interest generated in the work • "Apply what they have learnt"	• The conflict of "working" and "learning" • May not pass the "exam"	• Learning atmosphere of the work place • Individual learning skills

follows: it usually costs learners a lot of time, but not everyone can achieve the desired results; the "free rider" phenomenon is common as some members may complete most of the "work", while the others can easily "share" the group outcomes; and, even if each participant is required to speak, there will be situations where the learner carefully plans before their speech but may not participate afterwards. Successful inquiry learning depends on the group leader's organizational capability and interpersonal communication skills within the group.

(4) "Learning by doing" is considered as a good learning form but not easy to organize. The advantages are that participants are easy to engage, and the learning effects are good once the entire "doing" process is completed. The disadvantages are that learners are not willing to get effective help when facing difficulty and they may not pass traditional exams, which are memory-based. Successful "learning by doing" activities are highly dependent on the design of "doing" tasks and the appropriate mentoring and support provided in the learning process.

(5) "Work-based learning" is a fashionable learning method in vocational education and in-service training. Its advantage is that participants have a learning interest in the work, which usually results in "learning for practice". The disadvantage is the conflict of "working" and "learning". Working performance and learning effectiveness may not excel in parallel, or the learners may not pass the traditional exams. Successful "work-based learning" depends on the learning atmosphere of the leaner's working organization and the personal learning skills of the individual learner.

1.4 Five Laws on Technology Enhanced Learning

1.4.1 Technology Enhanced Learning (TEL) and Learning Scenarios

The traditional way of instruction includes teaching and learning, but now we can see that except for "classroom lectures", all of the other scenarios, "self-study" (such as "exams for self-study"), "inquiry learning", "learning by doing" and "work-based learning" have extended beyond this traditional way of thinking. With the popularization of the Internet learning materials are no longer the only method of distributing learning contents, nor is the blackboard the only teaching tool in the classroom. The Internet and multimedia have become an integral part of teaching and learning. Online learning has become a popular form of learning, and "blended learning" has become one of the most commonly used teaching strategies. For the public in general Technology Enhanced Learning (TEL) has become synonymous with almost all "information technology in learning" including eLearning.

The objective of TEL is to provide socio-technical innovation in learning practice for an individual or an organization in a way that is independent of learning time, place and progress, which enhances learning efficiency and input–output effectiveness. Therefore, TEL can be interpreted as providing support to any learning activity through technological means.

From traditional "blackboard and chalk" face-to-face classroom lecturing to classroom teaching supported by multimedia technology, and from online learning as the main form to the return of a more "rational" and more "realistic" blended learning, the teaching paradigm is transforming from a "teacher-centered" to a "learner-centered" paradigm, as shown in Table 1.3. The main changes are as follows:

- The instructional organization changes from how to "implement" teaching (how to give a better lecture) to "facilitating learning";
- The instructional objective changes from the delivery of knowledge to knowledge construction;
- Management changes from offering courses to creating a good learning environment;
- Quality control changes from the improvement of instructional quality (how to "teach" better) to the improvement of learning quality (how to create a better learning environment);
- Content arrangement changes from creating generic learning materials to creating personalized learning materials; and,
- Evaluation changes from "individual" evaluation to "open" evaluation.

Siemens (2004) states some significant trends in learning, including:

(1) Informal learning is a significant aspect of our learning experience. Learning now occurs in a variety of ways—through communities of practice, personal networks, and through completion of work-related tasks.
(2) Learning is a continual process, lasting for a lifetime. Learning and work related activities are no longer separate. In many situations, they are the same.
(3) Many of the processes previously handled by learning theories (especially in cognitive information processing) can now be off-loaded to, or supported by, technology. Many learning theories, especially on cognitive information processing that we used to believe in are off-loaded or supported by technology. "Know-how" and "know-what" will be replaced by "know-where", which means knowing where to find the required knowledge. Sparrow et al. (2011) have performed research on "google effects on memory". They argue that the Internet has become a primary form of external or transactive memory, where information is stored collectively outside ourselves. When faced with difficult questions, people are primed to think about computers and that when people expect to have future access to information, they have lower rates of recall of the information itself and enhanced recall instead for where to access it.

Table 1.3 The transformation of teaching paradigm

Teaching paradigm Contents for comparison	"Teacher-centered" paradigm	"Learner-centered" paradigm
Teaching organization	To "implement" teaching	"To promote deep learning"
Teaching objectives	To deliver knowledge	To construct knowledge
Management	To provide courses	To create a powerful learning environment
Quality control	To improve the quality of teaching (How to "teach" better)	To improve the quality of learning (How to create a better learning environment)
Content arrangement	To cover all learning materials	Learning materials vary with each individual
Evaluation	"individual" evaluation	"open" evaluation

In the past, in many cases, especially in the emerging fields of adult learning, vocational education, distance and open learning, learning theories such as behaviorist, cognitive or even constructivist do not give a reasonable explanation of current learning practice nor can they give guidance to instruction, instructional organization and instructional design.

Although research and development technicians and educational innovation facilitators have carried out in-depth discussion on the role of technology in education, ordinary teachers and learners have a more direct understanding of the potential role of technology. The role of technology in learning is shown most directly in the aspects of presenting learning materials, data storage, communication, management and cognitive assistance. Its specific forms are mainly that of digital learning resources, virtual learning communities, learning (teaching) management system software platforms and various related support tools. Table 1.4 describes each learning scenario and the potential role that technology plays in the scenario.

1.4.2 Conditions for Effective Learning Activities

Technology provides many potential applications for a variety of learning scenarios and generates new ways of teaching and learning. Initially, an organization or individual has high expectations on technology playing a large role in teaching and learning however, the actual effects are usually not as successful as expected.

The former president of Open University in Britain, Prof. John Daniel (2001) performed an analysis on e-learning and published his results. Firstly, in the past few years, the Internet has changed the definition of distance education. Before 1997, distance education generally referred to using broadband to implement synchronous teaching for distant learners in different places, with an emphasis on recreating the classroom environment (for example simulating face-to face-interaction). However, today the situation has changed; distance education refers to asynchronous teaching on the Internet. Secondly, the mode of asynchronous teaching on the Internet borrows from some traditional distance education concepts. In the simplest form, students study the contents of the course presented as html on the network and take online tests after each session. Third, this simple and ineffective mode of e-learning has been rejected by students. Currently, the development trend is to combine online instruction with a large number of other activities using a web based course to facilitate learning. However, this is not the only means of learning. Fourth, the experience of using a network in teaching at Open University shows that the best application of network technology in teaching is to facilitate interaction among people rather than delivering all contents of the course to the students' computer. Fifth, the value of the interactivity of the Internet and the facilitation of learning by 8,000 tutors is very valuable (Daniel 2001). Therefore, the simplest learning mode of e-learning described earlier is invalid,

Table 1.4 Learning scenarios and the potential roles of technology

Learning scenarios	Learning materials	Learning methods	Roles of the teacher	Potential roles of technology
Classroom lectures (collective)	• Materials/handouts • Presentation tools	• Listening to the teacher • Q&A/discussion	• Teaching • Q&A on site Organize discussion	• Tools for material presentation • Digital Resource Management System (data management)
Self-study (individual)	• Materials/handouts • Digital courses (online and offline)	• Read/browse	• Distance Q&A	• Digital learning resources (materials) • Virtual learning environment (for communication) • Q&A/Help Tools • Learning management system (process management)
Inquiry learning (group)	• Background materials • Study guide	• Discussion (on site and on line)	• instruct tasks/ways of discussion • Evaluation	• Digital learning resources • Virtual learning environment (for exchanges) • Learning management system (process management)
Learning by doing (community)	• Background materials • Operation guide	• Operation/experiment • Discussion	• Explicitly instruct tasks Mentoring • Evaluation	• Digital learning resources • Q&A/Help Tools • Data storage/management
Work-based learning (community)	• Background materials • Job description	• Work • Discussion • Reflection	• Explicitly instruct tasks • Mentoring • Evaluation	• Digital learning resources • Data storage/management

and the best application of network technology is to achieve interaction among people.

From the perspective of knowledge and learning in the information age, Huang et al. (2007) identify in a comparative study on e-learning between Chinese and British students that there are many differences in the methods of e-learning. Additionally the authors identify that there are differences in the methods of tutoring and in selecting learning materials. From this study, they identify the need to investigate whether e-learning really happens.

If we consider "whether learning happens" in a different perspective, it is about "effective learning". In a formal learning environment such as classroom teaching, it refers to the process by which students complete learning tasks, achieve learning objectives and self-development within a certain period of time by using appropriate learning strategies to actively process learning contents under the guidance of teachers. While in an informal learning environment, such as distance learning and e-learning, students may not be under the direct guidance of teachers, there may not be assignments, and the students may not just be using the knowledge learned in the course, but may also be applying other skills and knowledge. However, the student perception may be that a specific task does not lead towards self-development.

Are learning activities effective? Are they successful? A senior researcher at Microsoft, Randy Hinrichs (2003) points out the five indicators of any successful educational activity. They are motivation, time on task, collaboration, critical thinking and feedback.

Critical thinking is an important condition of effective learning activities, describing the learner's implicit behavior, which is difficult to observe. According to the definition of constructivist learning theory, teachers are no longer "philosophers" in the classroom, but function as a tutor and helper of learners. Therefore, "feedback" is a condition of effective learning activities. This is the external (especially tutors, instructors and service supporters) response to the external behaviors of the learners, so it is an external supporting behavior. So what are the motivation, starting point and explicit behaviors of effective learning?

The desire to learn is the driving force for intrinsic motivation, with the main emphasis on non-intellectual factors such as individual learning needs and learning passions generated in learning activities (Shi 1994). Learning interests refer to the positive understanding, willingness and emotional state of a person about learning. Learning interests can be divided into direct and indirect learning interests. Direct learning interest occurs when the student enjoys the learning process, for example via learning materials or learning activities, while indirect learning interest by the results of learning activities. The motivation of learners derives mainly from learning interests.

The starting point of learning refers to the learner's preparedness to the new learning, which is based on their existing level of knowledge and psychological development when they engage in new learning activities (Bransford et al. 2000). Obviously, the boundaries of the "level of knowledge and psychological development" become blurred for adults when learning new knowledge. Usually, based

on their cognitive capability, adults can "adapt to" or "make up for" the lack of some field of knowledge through learning. Learning interests are heightened when a learner is confronted with authentic problems, when they are aware of the social significance of the learning or its relationship with or to them. Authentic problems refer to those that are closely related to the work and learning of the learners. These authentic problems may be categorized as:

(1) Helping learners solve their practical problems;
(2) Helping learners understand and deal with difficulties in their work or personal life;
(3) Helping learners to enhance their "working" capabilities; and,
(4) Helping learners develop their personal interests.

These explicit behaviors can be directly observed by for example, throwing a ball, writing, or playing the piano, while implicit behaviors cannot be easily observed without the assistance of tools or experiments (Che 2001). Learning activities should be experienced as an explicit behavior, rather than an implicit behavior. First of all, the observable learning "activities" of the learners, such as reading materials, attending lectures, watching videos, doing homework, or completing a task, etc. are the necessary conditions of "learning". Secondly, the "experience of learning activities" refers to the learners' identification of the existence of such learning activities. When participating in "non-traditional" learning activities, if the learners can identify that "they are really learning", this can increase their sense of achievement and reduce their anxiety, especially when they have completed the assigned learning activities or tasks. Therefore, it can reduce their cognitive load.

The five conditions of effective learning activities are to start with authentic problems, to motivate with learning interests or willingness, to take the experience of learning activities as the explicit behaviors, to take critical thinking as the implicit behaviors and to provide tutoring and feedback as external support, as shown in Fig. 1.2.

Fig. 1.2 The five conditions of effective learning activities
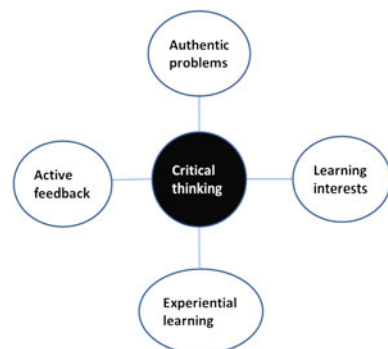
1.4.3 The Five Laws of TEL

When we consider TEL, there are three key elements; e-learning resources, virtual learning environments and learning management systems. These elements are also the fundamental components of e-learning systems. In the traditional classroom, these three elements refer to "the expansion of teaching materials", "learning places" and "classroom management".

1.4.3.1 Law 1: On Intrinsic Access to e-Learning Resources

e-Learning resources refer to multimedia materials running on multimedia computers and network environments and include digital video, digital audio, multimedia software, CD-ROM, websites, email, online learning management systems, computer simulations, online discussion, data files and databases. At present, the most typical forms of e-learning resources are multimedia materials in the form of webpages, which are usually organized according to curriculum objectives and content frameworks, and include descriptions of every part of instruction and learning activities.

In the US Ministry of Education White Papers of Educational Technology issued by the U.S. Ministry of Education, e-learning is defined as "the learning and teaching activities primarily carried out on computers and the network" (quoted from: Intelligence Development Institute of Shanghai Academy of Educational Sciences, 2001). The key to maximizing the effectiveness of e-learning is to intelligently integrate e-learning resources. The application of dynamic digital contents in instruction will increase the level of exploration and research of students. Professor He Kekang (2002) has described e-learning in this way, referring to learning and teaching activities on the Internet or in other digital formats, as achieving a brand new way of learning, making full use of learning environments with new communication mechanisms and rich resources provided by modern information technology. Such a way of learning will change the role of the teacher and the relationship between teachers and students in traditional instruction, which then fundamentally changes the structure of instruction and the nature of education.

In addition to clearly stating the need for learning and teaching activities, the above definition also implies that there should be clear educational objectives that are organized by "trained" teachers. However, it is often unconsciously interpreted that "new ways of learning can be generated by combining new communication mechanisms with e-learning resources", which implies a "common-sense" hypothesis.

Hypothesis 1 (About resources) Provided with e-learning resources of "high-quality", learners will take the initiative to browse or to "read through" all resources in order to learn more effectively than face-to-face teaching.

Due to the existence of Hypothesis 1, when we evaluate e-learning curriculum resources, curriculum resources of "high quality" usually emphasize "the integrity of the contents", "the diversity of media forms" and "the interesting presentation forms", etc.

In a great number of e-learning resources cases, the actual effects of e-learning are far behind people's expectations. From the view of learners, will they actually "seriously learn all e-learning resources"? The answer is obviously no, so Hypothesis 1 is conditional.

Law 1 (About resources) If learners take the initiative to browse or to "read through" all e-learning resources in order to learn more effectively than face-to-face teaching, the resources have to satisfy the following five basic conditions:

(a) (Required contents) The contents are of learners' interests or necessary for them to solve problems;
(b) (Moderate difficulty) The contents are of moderate difficulty and in an appropriate scale, so that cognitive "overload" will not occur;
(c) (Reasonable structure) The structure of the contents is simple and clear, which will not result in thinking "chaos" for learners;
(d) (Proper media) The media are presented in forms that are acceptable to the learners, so that they do not suffer visual strain;
(e) (Clear navigation) The navigation layout is clear with moderate depth so the learners will not get lost.

1.4.3.2 Law 2: On Virtual Learning Communities

Virtual Learning Environment (VLE) refers to a software system used to support learning and teaching in the field of education covering a variety of categories such as teaching support platforms, learning content management systems and discussion forums, etc. Virtual Learning Community (VLC) refers to a group of people who share learning as their primary purpose and share common interests or common discussion topics in a discussion forum. Wang (2005) defines VLC as a new distance education online teaching support platform based on the theory of constructivist learning, computer information processing technology, computer network resource sharing technology and multimedia information display technology. VLC is also a new type of learning structure, so it has sociological attributes as well as the basic attributes of the man–machine system. It is a combination of the requirements of modern society, scientific technology and the theory of learning and teaching. Sun (2005) describe the VLC as breaking through the limitation of time and space of traditional teaching and giving learners the possibility of developing their personalities and to collaborate, so that they can construct knowledge, experience emotion and interact with each other. The VLC has inherited and integrated relative elements of traditional communities, virtual communities and online learning and formed its own representative characteristics, which are technology, common interests and purposes, the exchange of

knowledge, inquiry learning and collaborative learning. The above definitions may also be described in the following two ways:

- "VLC is based on constructive learning theory and supported by the technical platform"; and,
- "with VLC, learners can individually construct knowledge, experience emotions and interact with others".

These two descriptions imply a "common-sense" hypothesis of people.

Hypothesis 2 (Virtual Learning Environment) Provided with a "convenient" VLE, learners will communicate as if they were in a an authentic classroom environment and in fact, sometimes even better than an authentic environment.

There are many "successful" cases of virtual communities in business, entertainment and games. These cases are not only popular, but also bring promising economic benefits. It is taken for granted that the "successful" experience is as effective as in the field of education or learning. If we have not achieved the expected effects, we usually attribute this to the "inconvenience" of VLE, which needs design improvements. Therefore, almost all e-learning systems are invariably equipped with VLC, which is regarded as the core component of the system.

Then, can VLC be as "active" as an "online business community" and "game community"? The answer is no. So Hypothesis 2 is also conditional.

Law 2 (About environment) If learners want to communicate in a VLE as in the authentic classroom environment and sometimes even better than an authentic environment, the following three basic conditions are required:

(a) (Sense of belonging to the group) Win the trust of learners so that they feel it is the place where they should "come", providing a sense of "belonging to the group";
(b) (Sense of personal achievements) Provide timely feedback to the learners, so they can find the answers and acquire a sense of achievement in the VLE;
(c) (Sense of emotional identification) Allow learners to gain a sense of emotional identification and release their desire of "competition", "performance" or " conformity" in the VLE.

1.4.3.3 Law 3: On Learning Management Systems

e-Learning management platforms are used to manage e-learning resources using certain methods and technologies in the VLE. With the continuous development and evolution of e-learning, e-learning management platforms have developed from simple management systems into powerful integrated application platforms, and depending on the emphases of their functions, they are also commonly known as learning platforms or learning resource management platforms. So far, learning management systems (LMSs) have different names in accordance with different emphases:

- Content Management System (CMS): The software system consisting of a tool or a set of tools to support content management.
- Learning Content Management System (LCMS): The system consisting of creating, storing, distributing and managing the personalized learning contents in the form of learning objects.
- Learning Activity Management System (LAMS): The system used for designing, managing and delivering online collaborative learning activities, including the learning management environment, the delivery of the sequences of students' activities, the operation and monitoring of teachers to students' activities, and setting up and adapting the activity sequences.

Qian and Sun (2005) defines an LMS as the network system used to effectively manage learning resources, learners and facilitators. Dalsgaard (2006) defines an LMS as well suited for managing student enrolment, exams, assignments, course descriptions, lesson plans, messages, syllabus, basic course materials, etc. LMSs play an important role in web-based teaching, are one of the infrastructures in network education and the main tool for the implementation of network education. "All LMSs have the following functions: user registration and management, courseware directory management, learners' information data recording and reporting to the administrator, etc. An LMS can help learners to arrange schedules on learning progress and to communicate and collaborate with other learners. It can help administrators to know about, track, analyze and report on the learning status of learners" (Yang et al. 2003).

Those definitions imply a certain logical relation, which is that "as long as there is an LMS, it can effectively manage learning resources, learners and facilitators". "An LMS helps with the study plan, communication and collaborative learning". It also implies a "common sense" hypothesis of people.

Hypothesis 3 (Learning management system) If the learners store relevant information in certain structures (in the database), administrators and teachers can effectively manage the learning process.

Learning management systems are "troublesome". In many cases, such as in the scenarios of "information overload" or "you can never find what you want", it is difficult to get the statistics of the information that you want (for example, what are the student's preferences). If the information is stored in a certain format in the computer database, the function of the database system should be to effectively solve the "problem", so the learning process can be effectively managed.

However, the notion that an LMS performs as we expect has been proven to be negative in many studies. It is important for the teachers to effectively manage the learning process of learners using the LMS.

Law 3 (About the system) For the teachers to effectively manage the learning process of learners using the LMS, the following four basic conditions must be satisfied.

(a) (Process coupling) The business model and the "teaching process" are highly coupled;

(b) (Performance promotion) A service-oriented system that can solve practical problems can reduce the work intensity of teachers or lead to better performance;

(c) (Data reliability) The data is safe and reliable so as to acquire the trust of teachers;

d) (Habit formation) The "metaphors" should be clear enough for teachers to easily understand the design of the LMS and therefore quickly "form" good habits on how to manage the LMS.

1.4.3.4 Law 4: On user's Understanding of the Designer's Intention

Both e-learning resources and VLEs and LMSs are artifacts designed by people. People often consider the following hypothesis on the designer psychology.

Hypothesis 4 (Designer psychology) Usually, users can clearly understand the design intention of e-learning resources, learning support platforms and learning management systems.

So far, there are many digital curriculum resources of "high quality" and evolving learning support platforms and management information systems with "comprehensive" functions, but how many designers will admit that they do not "carefully" design? Obviously, the sub-consciousness of designers trusts that the users should understand their design intention. In fact, Hypothesis 4 is completely wrong.

Law 4 (About design) Users may not clearly understand the designer's intentions of curriculum resources, learning support platforms and management information systems. Design that does not take into account user psychology is usually considered a failure.

In order to make users understand the design intention, the following three methods can be applied:

(a) The use of "metaphor" and "common sense";
(b) Clear and concise documents;
(c) A universal standard of labels and symbols that is made public and available to teachers and students.

1.4.3.5 Law 5: On Learners Asking for Help

When the designers design e-learning resources, VLEs and LMSs, they always have a hypothesis about the learner's mindset.

Hypothesis 5 (Learner mindset) Irrelevant of distance learning or on-site learning, learners will naturally turn to the teachers for help when encountering learning difficulties in order to achieve learning objectives.

With instruction organized on campus, a specific time and location are usually arranged for tutoring and answering questions. Teachers who make their contact information public so that students may contact them when having problems are

considered as "good teachers". With network education, "making the contact information of teachers, tutors and supporting staff public and appointing relevant staff on duty" is considered as the most typical form of learning support service. However, Hypothesis 5 is also completely wrong.

Law 5 (About users) Irrelevant of distance learning or on-site learning, learners may not turn to the teachers for help when encountering learning difficulties. So the "passive" type of tutoring is usually regarded as a failure.

In order to make learners turn to the teachers for help when encountering difficulties, there are three necessary conditions:

(a) Appropriate external pressure;
(b) The intimacy of teachers;
(c) Timely and effective feedback.

After clarifying the laws regarding TEL, the next step in the process then is to determine the most effective way of implementing digital resources into the connected learning paradigm.

1.5 The Transformation of Digital Resources from Nibbled Learning to Connected Learning

As Wiley (2000) digital resources are valuable in the support of learning. Digital resources are a very important component of connected learning as they fully reflect the needs of the learner, allowing for more effective learning in the current information age. The current forms of digital resources and their requirements in connected learning will now be discussed.

1.5.1 Typical Forms of Digital Resources for Nibbled Learning

Impacted by the habits of traditional teaching mode, digital resources in e-learning are stamped with the brand of nibbled teaching mode, which produces resources of "the knowledge maze" whose contents emphasize the structure of learning theories in a professional, systematic and complete way. People that conform to this idea specifically advocate for the resources organized and developed by the "experts". This preset learning mode migrates naturally from the part of nibbled teaching process to include three typical types; classroom migration resources, digitalized independent-learning resources and simple mixing resources. These correspond to the teaching forms of "classroom lectures," "self-study after class (reading materials) "and "listening to the lectures and reviewing".

1.5.1.1 Classroom Migration Resources (CMR): A Metaphor for Traditional Classroom Transfer

The main feature of this type is that teachers "move" the teaching contents from the face-to-face classroom to the Internet. Some of the lecture materials, teaching materials and electronic homework are presented in the form of web pages, some are recorded and delivered as part of the courseware using streaming media that can be watched on demand and some use the form of live video given as face-to-face lectures that may be viewed in real-time via the Internet from learning stations in other locations. All of the methods described that move classroom teaching to the Internet are referred to as the classroom migration type. With curriculum of this type, the teaching methods and structures have not been fundamentally changed, only the methods of delivering the information via an intermediary media have been changed. Chen and Yao (2006) point out that online teaching in many schools throughout China is still following the traditional teaching mode where the teachers are giving lectures as videos and the students are listening remotely using a computer monitor as the only medium. Presently, the number of students in China learning via distance education is enormous, and most of these students demonstrate weak self-study habits. Curriculum forms of this type require fewer teachers per student therefore allowing for more students. As this model is seemingly acceptable to students, its existence is reasonable. However, in this form of curriculum, the main features of online learning for the students' are passive learning, mechanical memory and the grasping of knowledge points. This does not meet the conditions of learning taking place (Huang et al. 2007). In many cases, real learning does not occur.

1.5.1.2 Digitalized Independent-Learning Resources (DIR): A Metaphor for the Digitalization of Self-Study Materials

Some online courses are presented as the type of digitalized independent-learning, which means that the teachers upload the learning materials and contents to the online curriculum platform for students' to access via self-study. In this curriculum form, teachers provide students with the learning materials, supporting exercises, review questions and assessment requirements, but they do not design corresponding learning activities for students or provide the required tutoring and support in the learning process. Curriculum of this type reflects the student-centered teaching philosophy to a certain degree, which allows for the openness and flexibility of network education, but the actual practices are not ideal. In the process of online teaching, most teachers still use network technology as the tool for displaying the learning materials. They upload these materials to the Internet for the students to read and to learn. Students often give up because of the lack of usefulness of this kind of learning. Teachers have not made full use of the advantages of the network environment; they just use the network for the sake of the network, which does not reflect the appeal of online education. Online learning

emphasizes individual learning of the learners, including taking initiative. In this type of online self-study, it is difficult for the learners to identify problems and to arouse their learning interests in the face of boring learning materials, or to experience the process of social construction in the learning activities, not to mention discussion and exchanges with the teachers for timely feedback. Under these conditions, the sense of loneliness and frustration of the students will become more serious, leading to very little critical thinking and ultimately to the proba-bility of giving up the entire process of online learning. Therefore, with curriculum of this type of online self-study, real learning is difficult to find.

1.5.1.3 Simple Mixed Resources (SMR): A Metaphor for the Mixing of Traditional and Digitalized Learning Resources

Curriculum of this type uses blended teaching, which means that teachers will move part of the teaching process and contents to the network, for example, by providing lecture notes and assignments on an LMS platform, while the other part of instruction is still carried out face to face in the classroom, or online in the "classroom migration" type. Compared with the curriculum of online self-study, the simple blended curriculum provides more learning support to online learners and it is currently the most widely used curriculum form in online teaching. The main disadvantage of the simple blended type is that teachers currently do not involve students in the constructive process of learning through the experience and interaction of systematic instructional design, in particular, the design of learning activities, so online teaching is simply blended with classroom teaching without effective integration. This means that the advantage of online learning has not been fully realized.

The above types of resources are products of the traditional teaching mode, which is a large part of nibbled learning, especially in regards to instruction delivered on campus. Firstly, these resources can provide a way of adjusting the teaching process in a class to account for the few students who do not keep up with the teaching progress or miss the class for various reasons. Secondly, they provide an effective way of accessing the resources between classes and schools for the few students with special interests and requirements, for example, facilitating students who are going to take entrance exams for postgraduate study. Thirdly, they provide an opportunity for teachers to share their teaching experience; this reduces the time of lesson preparation. However, these types of resources have little impact on promoting changes in the teaching mode, and in many cases, may even prevent it. Firstly, these resources further promote students' ability in the examination process, which reduces their interest in learning. Secondly, they provide the opportunity for some teachers to take the easy route, which further weakens their studies in the teaching materials and the teaching content. Thirdly, due to the easy accessibility of the answers, some students' understanding of the contents shows a decreased value, which will naturally lead to the decline of learning efficacy.

In the field of distance education, these resources fit to some extent into the habits of the learners that were formed in the traditional classroom. Currently, in China, the present distance learners are not qualified successful applicators of nibbled learning. With the conflicts of time in their work and learning as well as the irrelevance of what they learn compared to the requirements of actual work, the practical effects of these resources are not ideal. The field of distance education urgently calls for a new learning mode to solve the conflict of teaching and learning in the space–time separation of teachers and learners. However, as teachers and students are used to the nibbled teaching mode, this restricts the current mode of producing digital resources and the development of new learning modes.

1.5.2 Typical Forms of Digital Resources for Connected Learning

The change of learning form in China will long be affected by the influence of traditional nibbled teaching mode. This means that in the fields of e-learning and "network education", "classroom migration" and "online self-study" forms will take a long-term dominant position in learning. Any large-scale change of learning modes is a gradual process and it has quietly taken place in the informal learning environment. However, the change of teaching methods in schools is obviously falling behind it. The boundary of campus education and distance education will become increasingly blurred. In the aspect of the organization of learning activities, face-to-face learning and online learning will no longer exist in isolation, with blended learning becoming the replacement. The ideal mode of blended learning is the new learning mode, informatization learning mode.

It is widely anticipated that the new learning mode should have independence, inquiry and collaboration as its basic features. Independent learning should consist of self-planning, self-monitoring and self-evaluation. Inquiry learning should be oriented with open-ended questions and provide accurate assessments based on the definition of questions and learning outcomes. Collaborative learning should provide peer consultation, mutual inspiration and expressivity. This new concept of learning is defined by five typical forms of learning resources, specifically; mini courseware and "apps", task-oriented resources, experience-oriented resources, collaboration-oriented resources, and social learning resources. Following is a description of the components and orientations of the digital resources used to aid in organizing learning or learning materials. Of course, these five forms are not completely independent in a specific course; they are usually integrated or blended.

1.5.2.1 Mini Courseware and "Apps" (MCA)

Mini courseware and "apps" are suitable for learners who are busy working and have small slices of time available for learning as well as having little or no fixed learning location. Additionally, it is only suitable for learning less difficult courses, which only need the understanding and remembrance of some new concepts. Learning resources are mainly based on the design of mini activities. With this type, the number of learning activities may larger, but learning tasks should not be too complicated. During the process of organizing learning activities, a variety of recommended measures need to be taken. The forms of learning resources are mainly reading texts, listening to audio or watching video. These are best displayed on handheld learning terminals that support portability and are also suitable for reading. The evaluation is mainly based on objective and short-answer questions. The test results should be recorded and included as a part of the course scores.

1.5.2.2 Task Oriented Resources (TOR)

The basic characteristic of task oriented resources is to organize learning based on a series of "learning activities". From the perspective of learners, each learning activity includes four aspects; learning tasks, learning resources, evaluation methods and learning support services. Learning tasks require a clear description of the learning outcomes so that the learners can explicitly understand what they should do in the associated activity. Evaluation methods should adequately examine the completion of learning activities without focusing on the assessment of learners' memorization of the learning contents. Learning support services are extremely important, so the instructors or tutors have to understand the learning difficulties and learning environment of the learners so as to facilitate effective communication with them. There should not be too many learning activities in a course so as to reduce the cognitive burden of the learners. The basic principle of preparing learning resources is that they should be adequate and appropriate to completing the learning tasks with the result of reducing redundant resources.

1.5.2.3 Experience Oriented Resources (EOR)

Experience oriented resources are suitable for courses consisting of only a few concepts that focus on the training of operational skills. There are two types of these resources. The first resource is used to instruct and support operational skills in a real environment, and the second resource is used for virtual experiments or online drilling software. The former is used to examine the feasibility of real conditions, while the latter is used to examine the availability of virtual reality software. The forms of learning resources are mainly based on corresponding cases, clear operational instructions and specific methods of assessment and evaluation.

1.5.2.4 Collaboration Oriented Resources (COR)

Collaboration oriented resources refer to the type of learning activities that use organized groups with the primary goal of solving complex problems. The learning objectives of each individual are coherent with those of the group, and the evaluation of group members will be interdependent. The collaboration type is suitable for courses with relatively clear tasks and complex problems and ill-structured. The difficulty of this type is in how to design group-learning tasks and in grouping strategies. Sharing the group experience of completing the tasks is the foundation for the continuous development of collaborative learning in groups. The forms of learning resources are mainly based on corresponding cases, activity instructions and evaluation methods of tasks in groups.

1.5.2.5 Social Learning Resources (SLR)

Social Learning Resources are suitable for courses with open-ended questions, individual empirical knowledge and inquiry knowledge construction. The learning process usually includes problem definition, individual knowledge inquiry, group experience sharing and the expression of learning outcomes and so on. The difficulty of curriculum design includes how to evaluate the individual contribution of knowledge, how to motivate learners and how to intervene in the learning process and so on. The resources required are mainly based on the resource index, the rules and evaluation methods of experience sharing.

These five forms of resources are gradually being applied and accepted, especially in informal learning environments and related training. Over time, they will gradually become the mainstream form of learning resources.

1.6 Other Aspects on the Transmission from Nibbled Learning to Connected Learning

The construction of resources is the basis of the realization from nibbled learning to connected learning. In addition, the construction of the following aspects should be focused on in order to realize the smooth transmission from nibbled learning to connected learning.

1.6.1 Focus on the Research on Learning Psychology in the Technology Environment

First of all, it is required to study the differences of technology-based learning of different people. At present, the importance of the problem-solving capability,

innovative thinking, collaborative skills, information literacy and so on has been recognized, but how to eliminate the digital gap so as to enable all learners to have effective learning with the application of technology is the important research subject for the construction of environment and resources. Secondly, it is required to further study the characteristics of learning behaviors and psychological processes of human in the technology environment, how human and technology environment achieve interaction and what factors affect the psychology of the learners (such as motivation). With the development of technology and the advancement of the study on learning psychology in technology environment, researches in the field of educational technology will no longer satisfy the simple application of the technology, so the establishment of adaptive learning and collaborative learning environment will surely become the focus of pilot researches. Technology-supported learning environment will truly reflect the characteristics of openness, sharing, interaction and collaboration and so on. In this type of learning environment, there will be more emphasis on the non-intelligent factors such as the internal emotion of learners and on the role of social interaction in learning.

1.6.2 Pay More Attention to the Design and Support of Learning Activities

To achieve the connected learning, the instructional design should not only pay attention to the design of learning resources and learning process, but also more to the design and support of learning activities. The instructional design of connected learning will focus more and more on curriculum integration, especially the integration of general disciplines and information technology. In the process of integration, how to design research-based learning activities, authentic problem-based learning activities, integrated learning activities and collaborative learning activities so as to allow the learners to integrate the knowledge of different disciplines and how to cultivate innovative talents are the key points and also the difficult points of instructional design. The learning process and activities of the learners will be designed to be more flexible. In the learning process, the mentoring role of the teachers will become more prominent, and the studies on the support for learning process will become more important. The transmission of the role of teachers from "the sage on the platform" to "the mentor by students' side" also means that the instructional plan is no longer the design of the teaching process of the teachers as in traditional instructional plans, but should be transmitted to the "learning plan", where the learning process and activities of the students will be designed as an important part.

1.6.2.1 Learning Support and Services

To promote connected learning, we have to understand the learners first, and then provide personalized support and services according to the characteristics of learners. Therefore, learner modeling, the analysis of learning characteristics and the instruction in accordance with learning characteristics should be the focus in the future research and practice.

Educational technology has paid close attention to the support for student learning in research and practice, including the aspects of student learning activities, teaching organization and teaching evaluation and so on in the context of information technology in particular in the network environment. The teachers working in the frontline of education can deeply feel the problems in teaching, and only they can solve the problems with theoretical knowledge according to actual situations. The practitioners of educational technology should provide a variety of ideas and methods to solve practical teaching problems for the teachers so as to effectively support student learning.

1.6.2.2 Training for Teachers

The supporting service for the teachers is one of the key factors in the realization of the transmission of learning methods, which relates to the issue of training for teachers. All nations in the world attach great importance to the training for teachers. In 2000, the U.S. International Educational Technology Association developed "Basic Standards on Educational Technology for All Teachers", which standardizes the basic capabilities of educational technology that should be mastered by teachers, and systematic training on educational technology for teachers is required in order to achieve the standards. In addition, the U.K., France, Singapore, South Korea and other countries also attach great importance to the trainings for teachers. According to the survey, 1/3 of the teachers in the areas with the rapid development of educational technology in China still do not quite understand or even know about the knowledge of educational technology. It also shows that most of the teachers in the frontline of teaching welcome the trainings on educational technology with strong learning motivation. Therefore, it is a guarantee of realizing the transmission of learning styles to figure out how to carry out trainings on technology-promoted learning for teachers, especially how to implement effective trainings so that teachers in the frontline will truly understand the learners and understand how to use technology to promote effective learning of the learners.

1.6.2.3 More Comprehensive Review and Study on the Application of Computer in Education

So far, countries around the world have invested a lot of manpower, materials and financial resources to research and explore the application of new technologies in

the field of education. Delighted for the practice, we have to think calmly about several issues of the application of the computers in the field of education in order to obtain more comprehensive understandings.

The targets of the application: As proved in practice, computers are not equally effective in all disciplines and objects, especially related to the disciplines relevant to the humanities or the cultivation of personal emotions and those with emphasis on the cultivation of practical operation capacity. Therefore, it should be grasped that the application of computers in education should focus on which disciplines, knowledge points and learning objects and what kind of strategies should be used.

The conditions of the application: The application of computers in education should consider whether the leaders attach great importance, whether the funds can keep up, whether the teachers have basic computer skills, whether there are sufficient teaching resources to support and whether they have sufficient mental preparation and so on. There are close relationships among various conditions, so the standards and combinations of conditions vary to different regions and different schools. So the practitioners specialized in researchers on educational technology have to select different regions and different types of schools for scientific experiments by adequate investigations, field trips and comparisons, and then promote the successful experience.

The effectiveness of the application: The effectiveness of the application contains two meanings. One refers to the effects of the application of computer in education and instruction, which usually takes the evaluation results of the education and instruction as the primary reference. The other one refers to the ratio of the input and output, which is the issue of effectiveness. People have done a lot of work for the former, while they also pay more and more attention to the latter. However, there have been no practical research results on the effectiveness of the investment in the application of computers and other technologies in education so far, so it will result in the blindness of investment by people and also impede the further development of educational technology. The comprehensive study on the effectiveness of the application of computers in education will be an important part of the researches on educational technology.

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