

Use of ICTs for Vocational Education



Prof. K. K. Aggarwal
Chancellor, Lingaya's University
&
Chairman, MNIT, Jaipur

ICT for Vocational Education

- **NOT** a Panacea
- **HAS** enough Problems
- **BUT THEN**
- **EVERYTHING** has Problems
- We **HAVE** to find the **BEST(?)** solution
 - . Cost
 - . Time
 - . Constraints
 - . Technology

AND



ICT for Vocational Education is a Reasonably Good solution.
Presently **MOST** suitable & **LEAST** problematic solution.

Globalization and ICTs

- Globalization has created a new world order for doing business.
- New information and communication technologies have dramatically changed the way we live, learn, and work, and even think about work.
- The synergy of combining globalization with new technology has had dramatic economic and social impacts.
- Skills polarization leads to gap in income inequalities.
- In the past status and condition of vocational education did not match importance of its potential contribution to society.
- Information and communication technologies drive the new economy and human capital is its fuel.
- Economic prosperity now depends on brains rather than brawn.

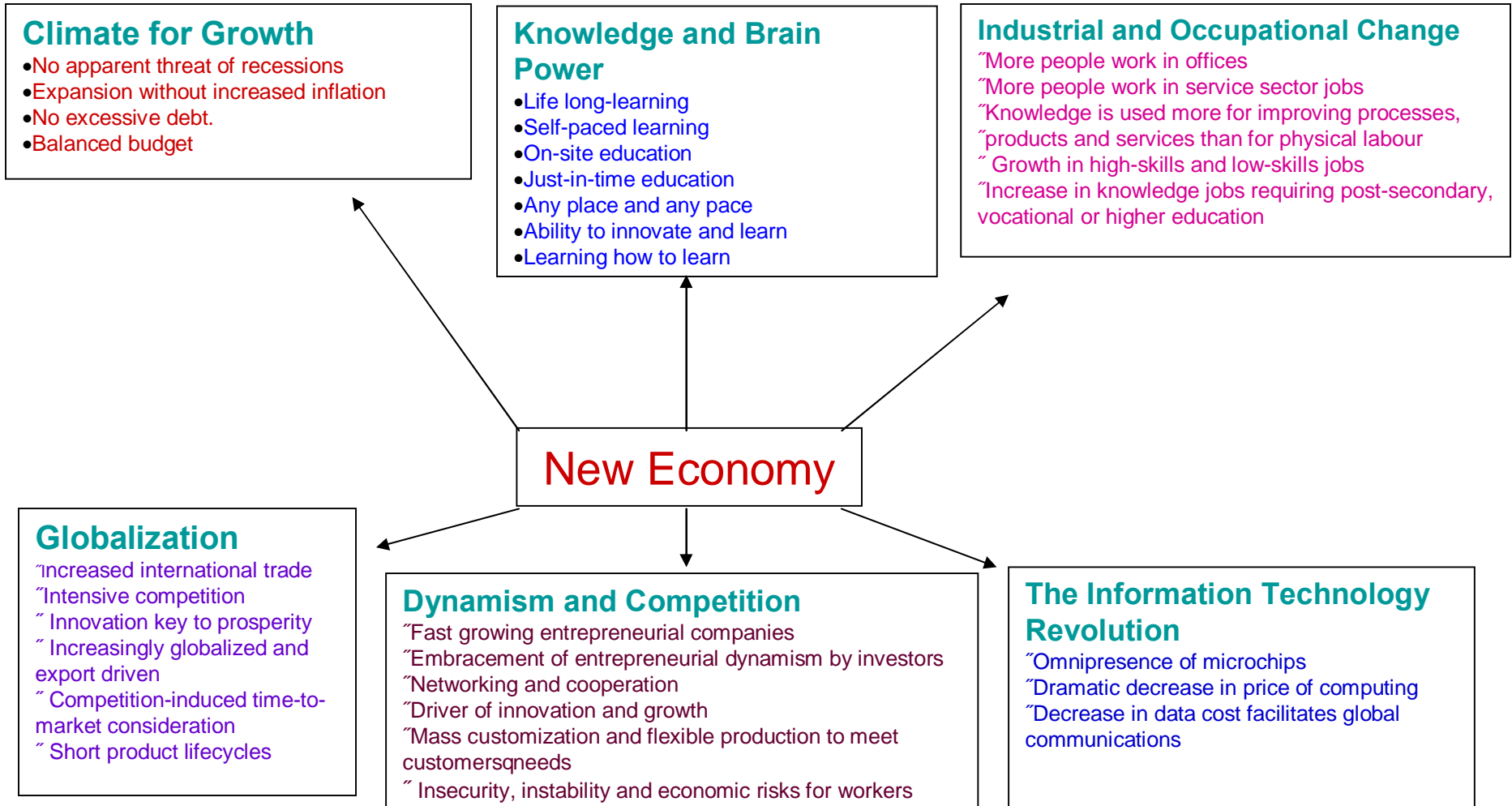
Five “New Economies”

Also known as	Period		Main symbols
New Economy #1	The Industrial Revolution	1787. 1842	Cotton textiles, iron, steam power
New Economy #2	The Bourgeois Kondratieff	1842. 1897	Railroads
New Economy #3	The New-Mercantilist Kondratieff	1897. 1939	Electricity, automobile
New Economy #4	The Cold-War Kondratieff	1939. 1989	Defence, television, mainframe computers
New Economy #5	The Information Age	1989. ????	Personal computers, telecommunications, entertainment

A good starting point for exploring the more structural features of the current new economy is found in *Wired* magazine's *Encyclopaedia of the New Economy*:

When we talk about the new economy, we're talking about a world in which **people work with their brains instead of their hands**. A world in which communications technologies create global competition . not just for running shoes and laptop computers, but also for bank loans and other **services that can't be packed into a crate and shipped**. A world in which **innovation is more important than mass production**. A world in which investment **buys new concepts** or the means to create them, rather than new machines. A world in which **rapid change is a constant**. A world at least as different from what came before it as the industrial age was from its agricultural predecessor. A world so different that its emergence can only be described as a revolution.

Today's New Economy



The Information Technology Revolution

- Rise of the new economy entails three trends.
 - “ The omnipresence of microchips
 - “ Dramatically decreasing costs of computing
 - “ Data costs are plummeting (co-depends on the previous trend)
- Global communication is, undoubtedly, one of the major enablers.
- The relatively smooth transition from the old economy to the current new economy (**also called “Digital Economy”**) has been caused by the emergence of information goods, which can be digitized.
- The prominence of information commodities entails three landmark events: the **invention of the microprocessor** in 1971, the **introduction of the IBM personal computer (PC)** in 1981 and the **commercialization of the Internet** in 1994.

- **Knowledge creation** requires highly educated creative skills at the very top of the skill distribution.
- **Knowledge deployment** requires widespread high-quality skills and education in the middle and bottom of the skill distribution.
- **Burton-Jones comments:**

Future wealth and power will be derived mainly from intangible, intellectual resources. This transformation from a world largely dominated by physical resources, to a world dominated by knowledge, implies a shift in the locus of economic power as profound as that, which occurred at the time of the Industrial Revolution. We are in the early stages of a “Knowledge Revolution”, the initial impact of which is becoming apparent in the volatility of markets, uncertainty over future direction within governments and businesses, and the insecurity over future career and job prospects felt by individuals.

- Resulting approaches to human resource management and organizational practices are: such as the following: hiring and layoffs, altering hours of work, using part-time and contract workers, subcontracting and outsourcing work, reducing hierarchical structures, adopting more fluid job designs, as well as implementing multi-tasking, multi-skilling, self-managed teams and multi-functional teams.
- Work is increasingly shifting away from manual tasks toward symbolic processing.
- The concept of "mind workers" or knowledge workers has emerged from this transformation of work and it appears to be the fastest growing type of worker.
- The re-engineered workplace expects workers to perform "more complex tasks, use new technologies, involve less direct supervision of workers, and acquire the use of higher skill and knowledge levels in making decisions and solving problems individually and as members of collaborative work teams".

Need for Flexible Access to VE throughout Life

- Workers of the future may expect to work on short-term assignments, on a contract basis, or within several project teams.
- They may have to work for more than one employer at any given time or even in new careers several times.
- Fifty per cent of technical workers' skills shall become obsolete within three to seven years.
- Lifelong learning is the only way to prevent obsolescence and remain competitive in a job market where work is becoming increasingly knowledge-intensive.
- The education model developed for the Industrial Age cannot achieve educational empowerment effectively in the Information Age. With ICT tools, we should be able to evolve the components of the conventional model into the corresponding components of the new model.

Applications of ICTs in Adult Education

➤ **Technology as curriculum**

When using technology as curriculum the focus is on developing ICT literacy skills.

” Generic ICT literacy skills.

” Occupationally specific ICT literacy skills.

➤ **Technology as delivery mechanism**

When technology is used as a delivery mechanism the focus is on packaging course content for digital delivery. Common approaches are: CAI, CBI, and web-based or online instruction.

➤ **Technology as a complement to instruction**

Providing opportunities to practice skills taught and extending learning by working with specific software applications. Simulators are often used to address safety concerns during the initial phase of training and to offset cost in renting equipment.

➤ **Technology as an instructional tool**

- “ Educators strive to use the little that is known about human learning whenever they engage in the act of teaching and learning.
- “ People learn through the five senses and the contribution of each to the amount that we learn varies.
 - ❖ Taste: 1%
 - ❖ Touch: 1.5%
 - ❖ Smell: 3.5%
 - ❖ Hearing: 11%
 - ❖ Seeing: 83%

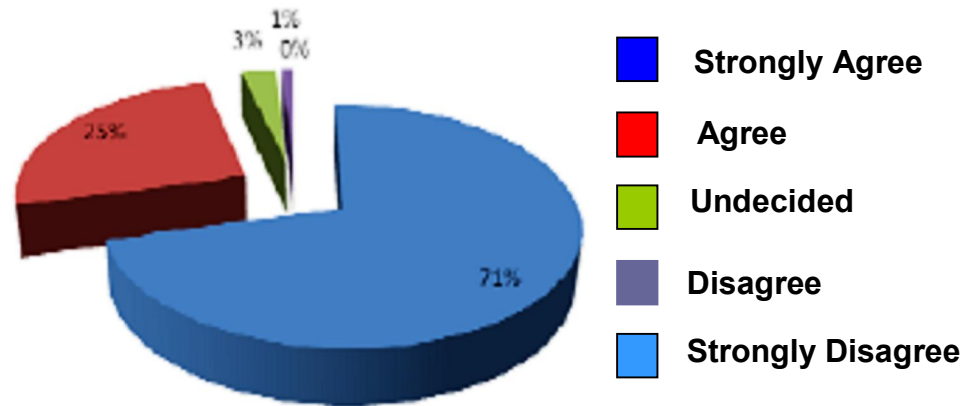
➤ The amount of information that people retain is also an important aspect of learning. We have some interesting insights regarding the amount of retention through the various senses over time:

	After 3 hours (%)	After 3 hours (%)
Material heard only	70	10
Material seen only	72	20
Material both heard and seen	85	65

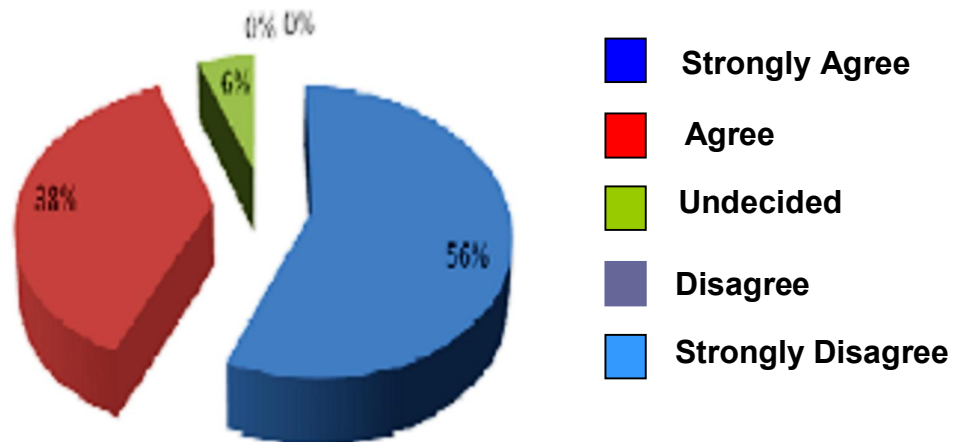
Appropriate Technology for Different Teaching Levels

TECHNOLOGY					
USE	TEXT	AUDIO	VIDEO	COMPUTER	INTERNET
Presentation	X	X	X	X	X
Demonstration	X	X	X	X	X
Drill and Practice	X	(e.g. Language Lab)		X	X
Interactive	hyperlink			X	X
Collaborative				Networked	X

ICT – Perceptions



ICT is very much helpful for improving the techniques of T-L process in VE



Students will be more motivated to learn if ICT tools are used in VE

- Key to effective education is : **MOTIVATION**
- Technology can be applied as a more individualistic approach to light the spark inside others and make them want to learn.
- **Preventing a motivated individual from learning is as hard as educating an unmotivated one.**
- The compulsion we have for entertainment is rooted in reward mechanisms in our brains (that is nature's form of Educational Technology)

- Our culture divides entertainment and education into two widely separated campuses; disservice to both activities.
- **Entertainment > Inspiration > Motivation > Education.**
- Entertainment and play have magical ability to inspire us.
- Need is to channel this inspiration to persistent motivation to learn more.
- ICT can play a very crucial role here.

Teaching Attitudinal and Practical Skills in VE using ICTs

- Effective human performance in VE consists of the successful interactive effects of skills, knowledge, and attitude.
- All programmes aim to develop all three domains.
- Considerable development of cognitive skills using ICTs.
- There is a perception that distance education is not an appropriate method for teaching and learning in VE.
- However, in high performance work environments, the cognitive and affective learning domains constitute greater segments of skill sets than do psychomotor skills.

➤ The psychomotor domain can be divided into 5 main categories:

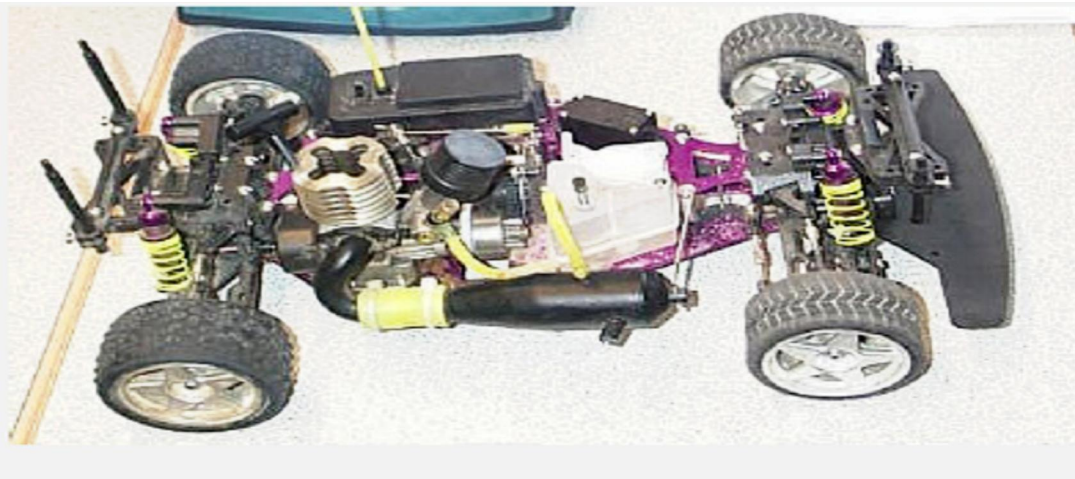
- “ **Imitation:** The learner goes through a period of trial and error to imitate an act that has been explained and demonstrated.
- “ **Manipulation:** The learner continues to practice the skill until some level of proficiency is attained.
- “ **Precision:** The learner continues to practice until he/she attains the competency requirement.
- “ **Articulation:** The learner attains a higher level of competency that allows him/her to solve problems.
- “ **Naturalization:** The learner reaches a stage where responses can be automatic, without thinking.

Construction of a car using simulation tools

French students and teachers at the iVET institution Lycée Nicephore Niepce have collaborated with other colleges in Europe to carry out an ambitious transnational project involving an intensive use of simulation tools, the Internet and videoconferencing. A radio-controlled car has been built in this manner.

The construction of the radio-controlled car across countries was made possible by using advanced simulation tools. Thus the mechanical pieces were designed and manufactured with CAD/CAM software (Computer Aided Design/Manufacturing).

The different parts of the car were made by different teams from different iVET institutions across Europe, and both students and teachers considered that it was a great challenge to make the pieces fit together. But the project succeeded in the end. The project is an example of how today's' industrial production is being conceptualized through an intensive use of simulation, and of how theory and practice can be integrated through the use of simulation in teaching and learning.



Campus Learning and Corporate Training

- Canadian employers increased use of e-learning from 17% to 24%. This is consistent with American counterparts who observed a growth from 19.8% to 24% in the preceeding 5 years.
- It is estimated that 50% . 70% of American firms use the web for instructional delivery.
- Reasons given by employers for using ICTs are: improved just-in-time workplace learning (60%), cost-effectiveness (45%), greater control of employees over learning (35%), and best fit with organizations\$ workplace learning needs (33%).

Interprovincial Computerized Examination and Management System (ICEMS), Canada.

The implementation of the ICEMS is a collaborative effort of the Canadian government through Human Resources Development Canada and all provinces and territorial governments. The purpose of the ICEMS is to automate examination development, administration, and assessment for 46 designated apprenticeable trades in Canada (listed below). A purpose-made software was developed for operating the ICEMS. The system contains item banks of questions and answers for each designated trades. It can also generate examinations according to a specific set of criteria, mark answer sheets, and output examination results.

Designated Apprenticed Trades

Appliance Service Technician	Industrial Instrument Mechanic
Automotive Painter	Industrial Mechanic
Automotive Service Technician	Insulator
Baker	Ironworker
Boilermaker	Lather
Bricklayer	Machinist
Cabinetmaker	Mobile Crane Operator
Carpenter	Motorcycle Mechanic
Cement Finisher	Motor Vehicle Body Repairer
Construction Electrician	Oil Burner Mechanic
Cook	Painter and Decorator
Electrical Rewind Mechanic	Partsperson
Electronics Technician – Consumer Products	Plumber
Farm Equipment Mechanic	Powerline Technician
Floorcovering Installer	Recreation Vehicle Mechanic
Glazier	Refrigeration and Air Conditioning Mechanic
Hairstylist	Rofer
Heavy Duty Equipment Mechanic	Sheet Metal Worker
Industrial Electrician	Sprinkler System Installer
	Tile Setter

Planning Model for Integrating ICTs in VE

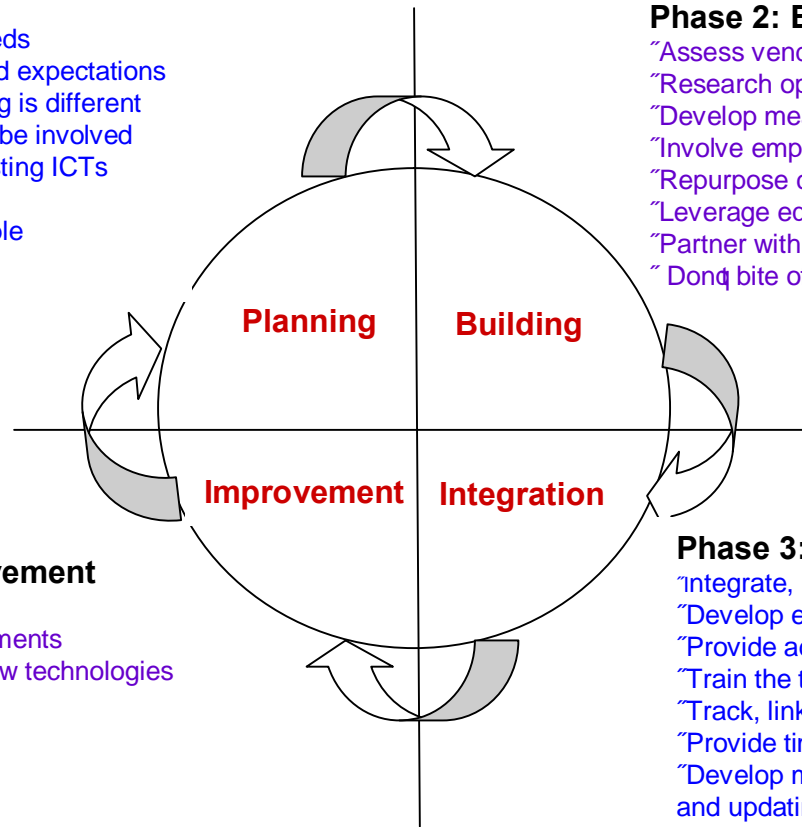
E-learning Planning Process

Phase 1: Planning

- ~Develop team
- ~Assess organizational needs
- ~Define learner needs and expectations
- ~Understand how e-learning is different
- ~Define work processes to be involved
- ~Assess and leverage existing ICTs
- ~Define budget
- ~Get seat at IT systems table
- ~Define e-learning model

Phase 2: Building

- ~Assess vendors and products
- ~Research options by content, technology and service
- ~Develop measures
- ~Involve employees in content development
- ~Repurpose content with caution
- ~Leverage equipment supplier training
- ~Partner with other organizations
- ~Don't bite off more than you can chew



Phase 4: Improvement

- ~Check and evaluate
- ~Determine improvements
- ~Assess/integrate new technologies
- ~Scale up or out

Phase 3: Integration

- ~Integrate, don't implement
- ~Develop e-literacy
- ~Provide adequate ICTs
- ~Train the trainers
- ~Track, link and measure
- ~Provide time to learn
- ~Develop mechanisms for content management and updating
- ~Communicate
- ~Build communities

New models of education and Training

- Three models of education are described, but in practice learning and teaching can be influenced by more than one model.
- For example, the practical nurse education is primarily characterized by the com-model as students use discussion forums and online-diaries intensively. But elements from the flex-model are also seen: e.g. offering students online exercises in the long training periods on the work places.
- The com-model: Intensive communication during the extended periods of on-the-job training
 - “ This new model is based on blended learning that uses web-based distance teaching and learning in combination with on-site teaching and learning at the institution plus on-the-job training.
 - “ The web-based part of the course is followed during the on-the-job training periods.
 - “ The model is based on communication between:
 - o Students and teacher
 - o Fellow students
 - o Students and the workplace
 - o Students and clients/customers

The flex-model: Flexible and individual teaching and learning; reduced amount of school-based training

- The flex-model uses e-learning to individualize teaching and learning and to increase the flexibility in teaching and learning with the aim of reducing the amount of school-based teaching and learning.
- As a consequence, the students need to be released from work for shorter periods than during traditional courses.
- This model is based on blended learning using distance learning combined with on-site teaching and learning at the institution. The web-based part of the course takes place while the students are working or doing their on-the-job training.
- The theoretical content is delivered to the students via the learning platform. Therefore the students primarily learn the theoretical component through distance learning. Practically-oriented learning too takes place virtually, since the students can download simulations and animations to test their theoretical knowledge prior to their on-site sessions.

The sim-model: Bringing school-based teaching and learning closer to reality

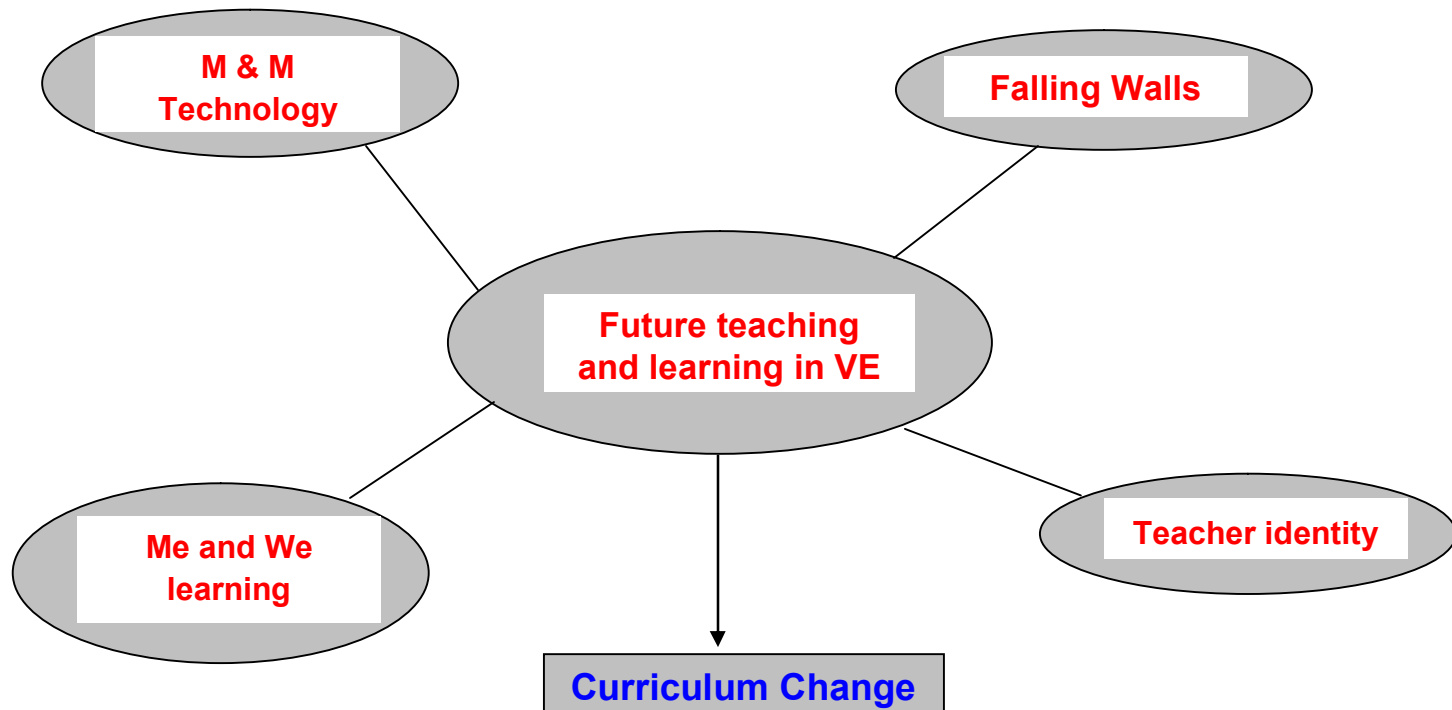
- The sim-model uses e-learning to strengthen the practical dimension in school-based teaching and learning.
- In this model, e-learning is used to compensate for the limited extent of on-the-job training.
- In this model especially, simulations are used for this purpose. E-learning is also used for tests and examinations in order to make them more realistic and practically-oriented.
- This might be very suitable for the isolated geographical location of the VE institution in question and the consequent limited scope for on-the-job training.

The current use of e-learning in VE

- It is established that e-learning is primarily being used for supporting teaching and learning at the institution and for blended learning.
- E-learning is typically being used as a medium for communication and simulations, as a general resource and in Learning (Content) Management Systems.
- The subjects considered to be characterized by an intensive use of e-learning are:
 - “ Electricity, gas and water supply
 - “ Financial intermediation and business activities
 - “ Wholesale and retail trade; hotels, restaurants
 - “ Manufacturing
 - “ Transport, storage and communication
- The subjects considered to be characterized by a moderate use of e-learning are:
 - “ Agriculture, fishing and quarrying
 - “ Construction
 - “ Public and personal services

Future Scenarios

- **Future scenario in relation to the use of e-learning in VE contains four key elements:**
 - “ **M & M technologies (modular and mobile learning)**
 - “ **Falling walls (e.g. in classrooms and institutions)**
 - “ **Teacher identity (in the roles of teachers)**
 - “ **Me- and we-learning (new learning paradigms)**
- **Correspondingly, the future scenarios imply that the use of the three models will increase extensively in the future as the price of technical equipment and infrastructure gradually declines and better technical solutions become available through technological advance.**





THANK YOU
FOR YOUR ATTENTION