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MATS CENTRE FOR DISTANCE & ONLINE EDUCATION

Information and Communication Technology in Education

Master of Arts - Education
Semester - 1

SELF LEARNING MATERIAL

ODL/MA/EDN/105
Information and Communication Technology in Education

Information and Communication Technology in Education

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MODULE INTRODUCTION

Course has four Modules. Under this theme we have covered the following topics:

Module 1 **ICT (INFORMATION AND COMMUNICATION TECHNOLOGY)**

Module 2 **MEANING, SCOPE, AND COMPONENTS OF EDUCATIONAL TECHNOLOGY**

Module 3 **BASICS OF EDUCATIONAL TECHNOLOGY**

Module 4 **COMMUNICATION AND INSTRUCTIONAL DESIGN**

These themes are dealt with through the introduction of students to the foundational concepts and practices of effective management. The structure of the MODULES includes these skills, along with practical questions and MCQs. The MCQs are designed to help you think about the topic of the particular MODULE.

We suggest that you complete all the activities in the modules, even those that you find relatively easy. This will reinforce your earlier learning.

We hope you enjoy the MODULE.

If you have any problems or queries, please contact us:

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MODULE 1:
ICT (INFORMATION AND COMMUNICATION TECHNOLOGY)

STRUCTURE

UNIT: 1.1 Fundamentals of ICT

UNIT: 1.2 ICT in Education

1.0 OBJECTIVE

- Understand the concept and nature of Information and Communication Technology (ICT).
- Trace the development of ICT from its origin to its current growth.
- Analyze the historical evolution of ICT in various sectors.
- Explore the role and significance of ICT in educational contexts.
- Evaluate the advantages of integrating ICT in teaching-learning processes.
- Examine critically the limitations and challenges of ICT in education.

UNIT: 1.1 Fundamentals of ICT

1.1.1 Information and Communication Technology: Concept and Definition

Information and Communication Technology (ICT) is one of the most transformative and ubiquitous forces in the history of society. More fundamentally, ICT covers the full range of technologies for creating, storing, and processing, transmitting and exchanging information in various forms. The concept of the term itself bridges two high-tech concepts over computer technology and communication technology that serves as a inclusion brought forth the 20th century and then divide them at second level by another well accepted modern Technology division of distance, additive or otherwise Non-subtracted) With without intersecting both sides. The scope of ICT is not limited to hardware or software components. It is an ecosystem that encompasses the devices themselves computers, servers, smart phones and network gear as well as the software they run on, including operating systems and applications, and the communications protocols (like TCP/IP) that let these things talk to each other. Moreover, ICT encompasses the tools and techniques as well as human know how needed to apply these technologies for communication purpose and information handling. This comprehensive view acknowledges the inability of technology itself to create value; instead, it has to be combined with human knowledge, organizational practices and social settings.

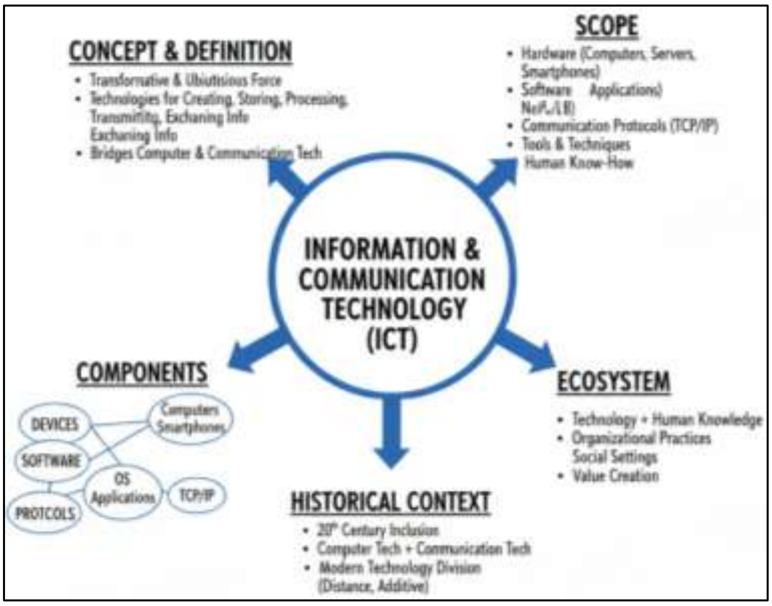


Figure 1.1: Information and Communication Technology (ICT)

Several academic and institutional definitions have sought to make sense of what ICT is. The United Nations Educational, Scientific and Cultural Organization (UNESCO) describes ICTs as an array of tools and resources used to communicate, create information, distribute it, store it manage it." By this definition, it is clear that ICT is to be multifunctional going beyond the bound of medium for communication purposes but as a holistic system for creating and utilizing knowledge. The World Bank provides a similar definition but in the context of technology. ICT is defined as hardware, software, networks and other facilities to collect, store, process, transmit and present information by using voice signals (analog sound waves), text-based communications between electronic devices or visual images such as figures on paper or computer monitor. Academically, ICT is on the convergence of computing, telecommunication and media technologies which has erased traditional borders between those areas. This coming together has opened up new opportunities for information processing and communication, which were not conceived in the past when these technologies worked individually. The combination of digital technologies and communication networks has changed the way that information is produced, distributed, accessed, and used in almost every domain of human endeavor. The range of ICT is huge, from older technologies like radio and television to the new technologies such as the Internet, mobile computing (Tele-working), cloud computing; artificial intelligence and robotics; wired telecommuting that didn't previously exist. This coverage is consistent with the evolutionary character of ICT, integrating new technologies but also utilizing established ones. The so arguing bounding concern skill is the 'purpose' which links together different forms of technology; which mediates across space and time enabling global communication, collaboration and knowledge exchange on a scale that has never previously been imaginable.

1.1.2 Nature and Characteristics of ICT

Dynamics, integrations, and transformations are inherent characteristics of Information and Communications Technology. As opposed to static; single-purpose technologies, ICT is characterized by its dynamic and evolutionary feature, as it evolves in concert with technological advancements, user requirements and societal needs. It is this evolutionary character that sets ICT apart from other technological areas and accounts for its nearly all pervading presence in almost all domains of contemporary society. Its digital nature has been the most dominant feature of ICT. Digitalization of information the conversion from analog signals to binary code made out of ones and zeros is an revolution in the way we store, process, and transmit data. These digital capabilities bring multiple advantages, such as high-quality perfect copies without loss of quality; easy storage and retrieval; rapid transmission over long distances because it travels over telecommunications lines at the speed of light in pulses of light (which can be transmitted at a speed close to that); and the transformation and manipulation that can be applied to information using computers in ways not possible with analog technology.

Digital technology has thus removed much of the physical limitations inherent in earlier communication and information systems which constrained the creation of environments where "information" could exist wholly independent os media.

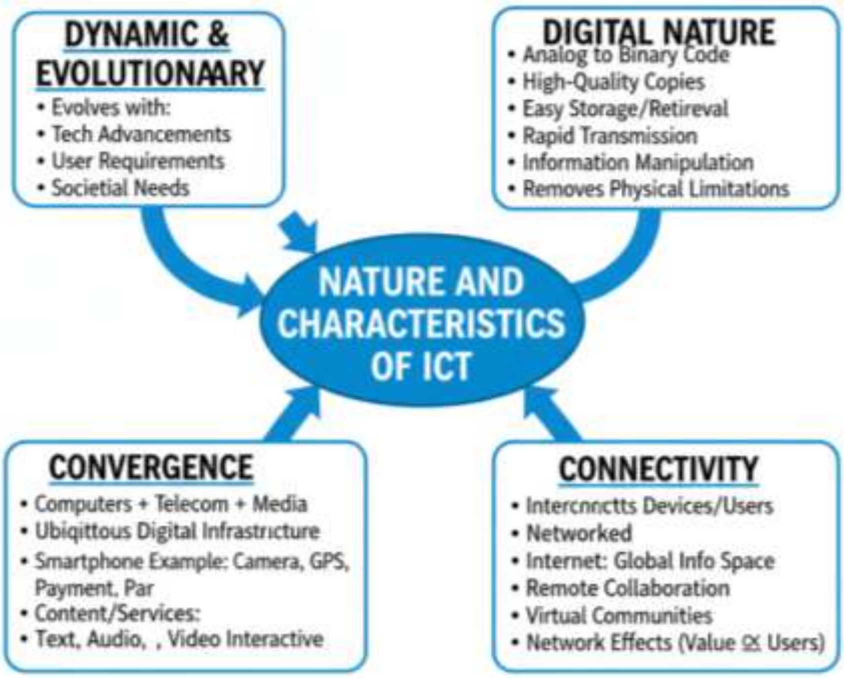


Figure 1.2: Nature and Characteristics of ICT

Another important feature of the modern ICT is convergence. For instance, computers, telecommunication and media technologies have all converged into a ubiquitous digital infrastructure in which distinctions between various types of devices and services have gradually vanished. This convergence can be seen readily in a contemporary smart phone which serves as a telephone, camera, video camera, computer, navigation system, payment device and entertainment medium. This is a convergence, not just of devices but of content and services to allow for multimedia experiences that combine text, audio, video, interactive.

The connectivity of ICT is possibly its most transformative aspect. Unlike earlier technologies, modern ICT is ultimately not technology at all; it attains its power not in stand-alone devices but in connectivity the capacity to interconnect millions or even billions of devices and users in networks or systems. The Internet is a classic instantiation of such networked architecture, providing a global information space without physically constrained by geography, politics, or cultures. This interconnectivity allows for remote collaboration and the development of virtual communities, as well as network effects a principle in which value of a product is exponentially proportional to the number of users or connections across technology infrastructure. Interactivity is the characteristic that sets ICT apart from earlier one-way lines of communication, such as television. Contemporary ICT products are fundamentally interactive: users are no longer just receivers of information but generator, editors and transmitters of information. This participatory aspect has empowered the production of information with direct consequence on passive recipients of info in the ecosystem. Social software applications, wikis, blogs and cooperation tools are manifestations of this which allow user-generated content and peer communication at an unprecedented scale.

ICT is a hugely scalable technology, and can employ machines from the size of personal devices to global infrastructures serving billions of users. Especially the cloud computing architectures show this characteristic of being able to allocate resources on-demand. This fluidity allows small businesses to access computing power that would have been cost prohibitive in the not-too-distant past, as well as enable large applications and services to take advantage of massive computational capacity when available. Another important feature is the speed and immediacy of ICT. Distance is a mere word as data travel in less than seconds around the world, making live communication and collaboration possible between continents. This ducking of time has, in many cases, revolutionized everything from commerce to science to emergency response -- basically anywhere the timely exchange of information is paramount. Information is now permanently available at any time during the day as ICT infrastructure will be up timestamp up all the time and there are no windows.

Contemporary ICT deployment is consumption-oriented and mobile. ICT has become detached from fixed locations by the rapid growth in the number of wireless technologies and mobile devices, allowing access to information and communication services anywhere with network coverage. This mobility has lead to the changing of work patterns, social networks and life-styles that have developed a state of always being connected for most people on this planet. Technological miniaturization has led to very powerful computational and communication devices that may be carried in a pocket or otherwise worn, but which still possess significant functionality.

1.1.3 Development of ICT: Origin and Early Innovations

The history of ICT is quite a remarkable one that touches thousands years, even though the forms of ICT cherished today were primarily among those flourishing during 19th and first half of 20th centuries. This trajectory can only be decoded by investigating the evolution of information processing technologies and that of communication systems separately: finally to be united, and now providing a closer integration with the ICT ecosystem that we recognize today. The conceptual underpinnings of information technology as we now understand it: first appeared with the transmission of information from afar (and its writing out).

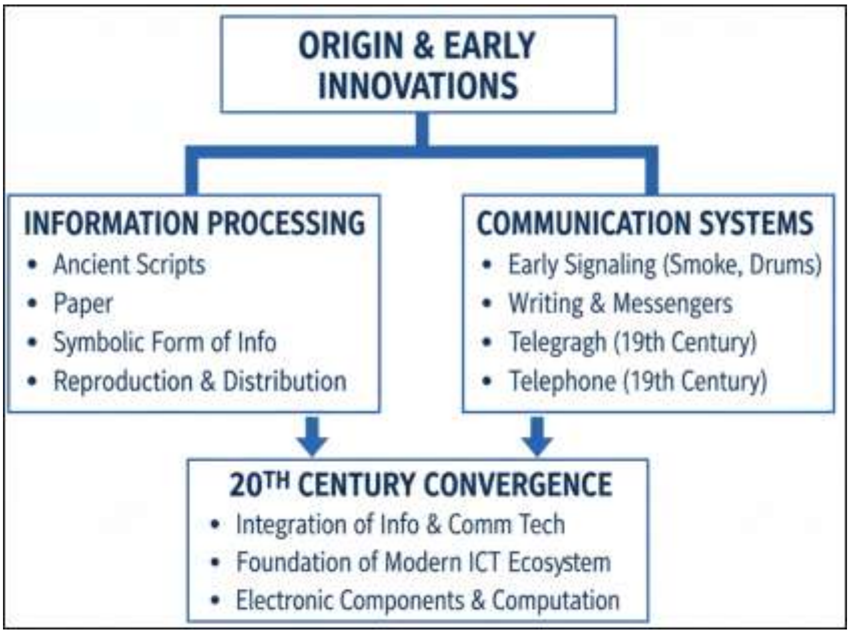


Figure 1.3: Development of ICT: Origin and Early Innovations

Even pre-literate peoples have tried to find ways to record knowledge. The ancient scripts, and paper and printing were among the fundamental initial developments in information technology, although none of these had physical computation or electronic components that we associate with ICT. These were the two key innovations in this period that set the stage for important principles reducing all information to a symbolic form, reproduction and distribution of information content being connected to reproduction, and transmission and storage of such symbols become storing symbol tokens as 'text' that is found in even modern information techno logy (IT) systems. Origins of computer technology and ICT One of the first artifacts that emerged recognizable as a precursor to modern ICT is the calculator or mechanical calculation device. In the 17th century, mathematicians and mechanical inventors like Blaise Pascal or Gottfried Wilhelm Leibniz built mechanical calculators that could perform operations such as addition. It was these, however limited, concepts that laid the ground for the automation of mathematics by a mechanical method. The 19th century saw more widespread innovation in computing, most notable being Charles Babbage's design of the Analytical Engine in the 1830s.

Although incomplete and never actually constructed in Babbage's lifetime, the design included logical features vital to modern computers - a processor that is programmable which you can store data on, and which will make choices based on conditions during these calculations. Ada Lovelace's notes on Babbage's Analytical Engine are especially important. In her notes, which were published in 1843, she recounted how the engine could be instructed to perform complicated calculations and even speculated whether it might manipulate symbols other than mere numbers.

The forward thinking of this man laid the blueprints of what would become decades before electronic computers made it possible. This insight of Lovelace predated a key idea behind the operation of modern computers: that such machines could treat whatever represents some information (formulated as symbols and manipulated according to rules) as numbers, so long as there are methods for translating those other forms such as physical processes or written language into what can be translated back to them. The evolution of communications technology was another similar, and yet different, story.

It was a radical innovation for long distance communication that emerged in the early part of the 19th century with the creation of a capable telegraph. Samuel Morse's electromagnetic telegraph, shown off in the 1830s and 1840s, made it possible to send instantaneous dispatches through wire networks (a change that would transform commerce, journalism and military messages). The telegraph introduced a new, electronic means of communication that eventually exerted its influence on the conceptualization of the latter-day telecommunications entries. The telephone In 1876 Alexander Graham Bell invented the telephone, which took communication to a new level. Unlike the telegraph which sent coded messages that required a special ability to send and receive, electronic communication via voice could be easily comprehended by much of the population. The telephone network, which evolved out of these years, was the first universal electronic communications system; it required fixed physical connections between end points and involved switching at many levels for its operation (including multiple levels of prospective interconnection with any other phones). Which elements existed as a function of legal requirements are somewhat obscure in that re-mix.

Wireless communication developed in the last half of the 19th century and first half of the 20th century. “Replaceability” and “Mobility”: Technical development since the 1890s the completion of Guglielmo Marconi's experiments on practical radio telegraphy in the 1890s showed that information could be sent across open space with no physical link, potentially allowing communication with mobile receivers such as ships at sea. The technology developed at an incredible rate, moving from Morse coding of signals down a wire to voice and then on to broadcast radio which soon became the dominant form of mass media in the early 20th century. Early techniques for calculating were developed in the 1930s and 1940s by mathematicians and logicians. Alan Turing's formulation of a universal computing machine early in 1936 implicated the idea that computation is about to have with real machines, but it also laid the theoretical foundation for reflecting on computation itself what could and what could not be computed algorithmically.

Information theory was first developed by Claude E. Shannon in the mid 20th century to find fundamental limits on signal processing operations such as compressing data and on reliably storing and communicating data, its beginnings can be traced back to classical works in thermodynamics dating from the early 19th century)by Ludwig Boltzmann on statistical mechanics, by James Clerk Maxwell on the application of probability theory to gas particles, Rene Descartes Mantra if knob a is turned invention of logarithms). Electronic computing was fast-tracked by the crucible of World War II. Computers Grew out the Military demand for complex calculations, especially of ballistics (for artillery trajectory tables), cryptanalysis and the development of nuclear weapons. The large scale electronic digital computers, the Colossus machines at Bletchley Park for codebreaking and the ENIAC (Electronic Numerical Integrator and Computer) at the University of Pennsylvania first appeared. Although these machines were primitive by the standards of the 1990s-2000s, they demonstrated that electronic computing was indeed possible and laid the foundation for a working logic-based computer engers of later generations.

1.1.4 Growth Trajectory of ICT: From Mainframes to Mobile Computing

The evolution of ICT from the mid-20th century to date is one of the most radical shifts in technology history; it has entailed exponential leaps in computing ability, dramatic declines in costs, and revolutionary consequences for access and scope of application. This evolution can be described in a number of interleaving eras reflecting both dominant technology paradigms and patterns of use. The mainframe age, from the 1950s to the '70s or so, made computing a practical technology for business and science and government. Mainframe computers like IBM's System/360, released in 1964, provided never-before-seen computing power and made it possible to automate complicated data processing jobs, keep massive databases and make complex scientific calculations. But the mainframe itself was extremely expensive, large and required a climate controlled dust free environment with raised floors, as well as an operator on-site and programmers. IT at the time was centralized, there were no direct access PCs, you submitted a batch job and got output some hours or days later. This concentration implied that computing was only available to big business, with deep pockets.

The invention of the semiconductor integrated circuit in the late 1950s, and its subsequent shrinkage thanks to Moore's Law (the observation that transistor densities on ICs doubled roughly every two years) laid down the technological base for computing's democratization. The minicomputer, a smaller and less expensive alternative to the mainframe introduced in the 1960s and '70s, became a way for medium-sized businesses, university departments and research laboratories to have access to computing. Firms such as Digital Equipment Corporation (with the PDP series) and Data General (the Nova) introduced computers for companies that previously could not afford computers but now found that they could be more productive, thus demanding computer time. The microprocessor revolution of the early 1970s (and in particular Intel's development of the 4004 and later processors) paved the way for personal computers arguably, one of greatest periods in ICT history. The PC democratized computing and brought it out of the control of institutions for use by individuals. Personal computers such as the Altair 8800, Apple I and Commodore PET were early forms of home computers that became popular in the 1980s but their story began back in the 1970s when they were non-commercial (hardware and software) hobbyist projects for digital electronics enthusiasts. In schools in other parts of the world such as India or South Africa, most students having completed a basic computer literacy course before finishing high school.

The personal computer generation changed everything about our perception of users and computing equipment. Computing was now interactive, programs could be debugged immediately, and created a new model of work in small increments. Graphics-oriented user interfaces, first marketed commercially in 1981 and introduced at Xerox PARC in the late 1970s, have enabled computers to be used by people without any specific computer programming knowledge. Software programs boomed, serving everyone from word and number crunchers to desktop publishers and computer designers.

Throughout the 1990s, personal computers were omnipresent in workplaces and increasingly widespread in homes of developed countries. The rise and continued proliferation of the Internet is a parallel but converging path to ICT development. The technical roots of the Internet date back to the 1960s with ARPANET, a U.S. Defense Department research network, but it largely became a global communications backbone in the 1990s. The creation of the World Wide Web by Tim Berners-Lee in 1989 opened the Internet to non-technical users, who could easily access it via browsers as well as navigate between pages using hypertext systems. It would become the battlefield of the browser wars, fought between Netscape Navigator and Microsoft Internet Explorer, accelerating web technologies and user experiences.

The late 1990s rise (and crash) of the dot-com era defined the Internet as a foundational form and function of commerce, communication, and information delivery. We had e-commerce as a model for business, email as the main platform of business conversation and web was all about information gateway open from any place having internet connection. Search engines, especially Google after its introduction in 1998, turned this information ocean into a navigable landscape, entirely shifting how people reach and learn about knowledge. In the early-21st century social media and Web 2.0 concepts became mainstream, putting more of an emphasis on user-generated content and social interaction. From Facebook to Twitter to YouTube, the platforms upended the Internet as a system for distributing information and instead turned it into a space with its own faces new ways of communicating, coming together and cultural production. This was in part due to broader trends of changing ICT use, where users were increasingly creators as well as consumers of content.

Mobile computing is the latest wave in the evolution of ICT. Portable personal computers were available as early as the 1980s, but mobile computing became widely available (and rapidly moving into the mainstream) with smartphones introduced after Apple’s release of the iPhone in 2007. Smartphones packed computing power, an internet connection, sensing capabilities and countless ways of communicating into your pocket. The resulting wave of mobile devices, bolstered by ever-improving wireless networks transitioning from 3G to 4G and now to 5G has ushered in an always-on, location-sensing computing ubiquitous in the lives of billions around the world. Cloud computing, popularized since the late 2000s, is another major ICT architecture breakthrough. Instead of using local servers and PCs, cloud computing takes advantage of services provided over networks from large data centers, which gives its users huge scalability, reliability and even access to sophisticated functionality with only minimal investment in local infrastructure. Today, Amazon Web Services, Microsoft Azure and Google Cloud Platform are infrastructure backgrounds for an enormous number of applications and services.

1.1.5 Key Milestones in ICT Development

In the story of the development of ICT there are certain remarkable milestones key inventions and events that irreversibly changed the field of technology, creating new potentials for both communication and information processing. Knowledge of these milestones provides an understanding of how current capabilities in ICT have evolved, and directions for further progress that are offered by new applications. One of the most important breakthroughs in the history if ICT is the discovery that came from Bell Laboratories in 1947, named as transistor made by John Bardeen, Walter Brattain and William Shockley. The transistor took over from the vacuum tube as the essential building block of electronics, providing a vast improvement in size, power consumption and reliability of electronic systems for X radiography. The practical realization of the short crossbar got a grip on miniaturization and mass production of electronics, the basis for all further advances in digital electronics and computing.

The invention of the integrated circuit by both Jack Kilby at Texas Instruments and Robert Noyce at Fairchild Semiconductor in 1958-1959 was the next significant development. ICs put several transistors and other electronic components on a single semiconductor chip, also allowing miniaturization and increase reliability and decreased cost. The ensuing advancement of integrated circuitry in accordance with Moore's Law leading to exponential increase in transistor density has enabled the remarkable advances in computational performance that have characterised the digital era. The invention of ARPANET in 1969 is a key event in both communication technology and the Internet. Funded by the United States Department of Defense's Advanced Research Projects Agency (ARPA, later DARPA), ARPANET was the first network to use this method and also began the development of the protocol suite TCP/IP. The network protocols created for ARPANET included the Transmission Control Protocol, the Internet Protocol and other long used protocols now collectively referred to as TCP/IP (the term comes from two of the most important of these protocols) which became a worldwide standard among operating systems, creating an instant de facto standard upon which many individuals built alternative versions.

It’s kind of fun when we realize the “text but with more people!” aspect of something like Twitter was already apparent way back in 1971 when Ray Tomlinson invented email, first a program that just allowed text files to be passed between different users on different hosts connected to ARPANET and, later, one of the most popular forms of electronic communication in history. Tomlinson’s choice of using the @ symbol to test and separate user names from host names became a rule that still exists. Email showed that the Internet could be a communication platform, not just a system for sharing resources, and it was when the Internet began to spread beyond academia. But the arrival of the IBM Personal Computer in 1981 marked a turning point when personal computing became a major tool for business people, not just hobbyists. IBM's first foray into the PC realm legitimized the technology before corporate users, and its open architecture led to a thriving clone market and software base as well. The success of the PC along with software breakthroughs like Lotus 1-2-3 and WordPerfect made personal computers an indispensable business tool, and eventually revolutionized home computing.

The creation of the World Wide Web by Tim Berners-Lee from 1989-1991 at CERN has changed the Internet for a specialized use net in an into mass media. Berners-Lee´s development of HTTP (Hyper Text Transfer Protocol) and HTML, the first Web browser made possible to create & link information with the ability to access it. The introduction of the Mosaic web browser in 1993, the subsequent release of Netscape Navigator in 1994, and Microsoft's Internet Explorer in 1995 led to a rapid increase in web users, which led to an accompanying increase in the use of TCP/IP. In 1998, Google was founded by Larry Page and Sergey Brin, it forever changed the way we find and consume information available online. Google’s PageRank algorithm was an order of magnitude better than that of the search engines before, and suddenly the ballooning web became useful and navigable. Google’s triumph cemented search as a core Internet service and bequeathed on search advertising a business model that would fund loads of the free content and services that dot today’s web.

Apple's iPhone launched in 2007 changed the mobile computing landscape entirely, and the company is now largely responsible for shaping the smartphone category we have come to know. Although smartphones before the iPhone offered limited software applications, including mobile apps that were used as digital voice recorders and came built in with a mobile operating system provided by the manufacturer, but these served more as operating systems than application platforms. The first i-Phone and its successors, along with the first Android device, caused phones to become general-purpose computing devices that were capable of providing mobile Internet access to more than one billion people on the planet. While introducing social media platforms marks another major achievement in ICT evolution.” Although social-media networks of a sort appeared in the early 2000s, Facebook’s post-2006 expansion beyond colleges and high schools had opened this world up to virtually everyone, while Twitter, which debuted in 2006, and YouTube whose growth exploded after its launch in 2005 were changing how information was communicated and consumed. These platforms made user-generated content and sociality central to the experience of the Internet, new community, cultural production, and forms of political engagement.

The introduction of cloud computing infrastructure and platforms well into the 2000s, with Amazon Web Services launching EC2, S3 for public access in 2006 has fundamentally changed how applications are built from that point onwards. Cloud services made it possible for organizations to access computing power when they needed it without having to put money down on capital infrastructure; this facilitated the creation of startups, brought about rapid scalability and disrupted IT practices across vertical markets. The cloud is now prevalent across a wide variety of applications and services, heralding the advent of computing as a utility service rather than a product.

ICT (Information and Communication Technology)

One of the more recent major milestones has been with the explosion of artificial intelligence, such as expertise in machine learning (ML) and deep learning, that started in around 2012. Recent breakthroughs in neural network architectures, learning algorithms, along with access to large scale data and computing resources have led to AI systems surpassing human-level or superhuman performance in numerous application domains such as image recognition, natural language processing, game playing, and content generation. These functions are currently being integrated into numerous ICT applications and services, including virtual assistants and unmanned vehicles and may be leading to a new wave of revolution in the development of ICT similar to previous transformative developments.

Information and Communication Technology in Education

Unit 1.2: ICT in Education

1.2.1 ICT in Education: Concept and Rationale

Information and Communication Technology (ICT) has been incorporated as part of contemporary education, transforming how teaching, learning and administration is conducted. Whereas ICT refers to a wide range of computer, information and communication technologies such as computers, mobile phones, the internet, multimedia news applications or learning management systems and software to enable the creation, storage, retrieval and distribution of information. Regarding education, ICT is used to improve quality, access and efficiency in both formal and informal teaching processes. Its educational value is based on the understanding that the current knowledge economy relies more and more on digital literacy and technological skills. Learners and teachers are assumed not just to learn content knowledge but also information processing, critical thinking, problem solving and collaborative learning skills that are supported by ICT tools.

The reasons for infusing ICT in education are many. ICT is a change-agent for renewal of the teaching-learning process from traditional teacher-centric to student centric educational practices. When we want to add a new way of representing, highlighting something in the data, or pointing out an issue from our study about Grey MBTs dropout in PPT/DD1510 course, we create these boxes: figures 3-6; formatted texts and lines with the option flexible size. Secondly, ICT presents the prospects of lifelong learning by giving access to massive pools of resources in online libraries, educational portals and virtual courses' halls. Such access allows students to learn information beyond the context of classroom teaching and around the timeframe of the school year. Third, ICT covers the changing requirements of learners in a globalized world where digital communication and collaborative problem solving and adaptive learning technologies are necessary competences. Furthermore, ICT aids in administrative efficiency in schools and universities by simplifying the administration of student records; increasing identification and follow up of students through assessments data; allocation of resources among others along with facilitating the communication between teachers, students, and parents.

Together, those above factors have made a strong conceptual as well as practical case for infusing ICT in the education system.

ICT (Information and Communication Technology)

1.2.2 Advantages of ICT in Education: Enhanced Learning, Accessibility, Engagement

Embedding ICT in learning environments provides numerous advantages and changes the way we teach and learn. Increased learning is another of the major pluses. However, digital resources can help educators break down difficult ideas in more easy-to-understand ways.Interactive media content (e.g. animations, simulations and educational video) that enable students to see otherwise abstract concepts in action and experience a sense of the real through engagement with interactive multimedia resources. Science students, now can conduct virtual science experience that simulates laboratory work, meaning they get practical knowledge without being limited by the constraint of physical resources and lab. Similarly, dynamic software that simulates equations and graphs can help develop and retain mathematical concepts. This way, ICT acts as a link between theory and practice leading to active learning and critical thinking.

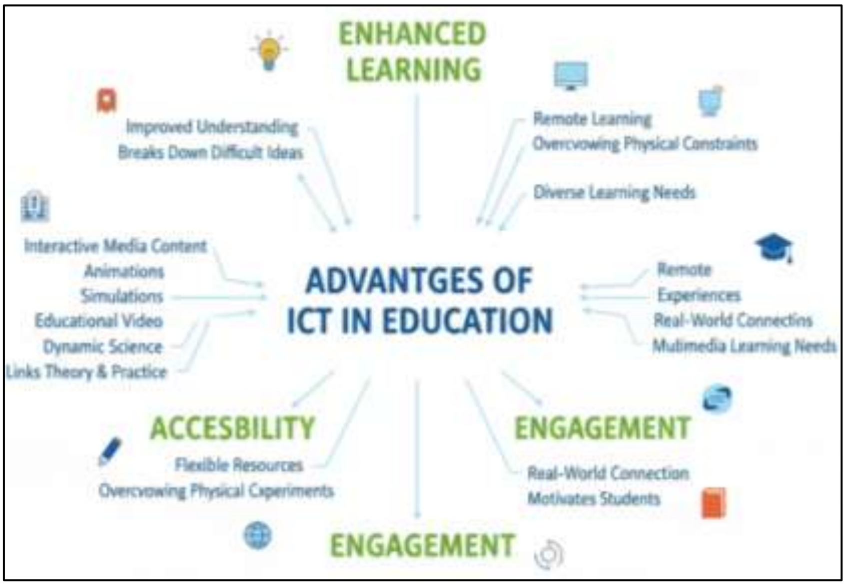


Figure 1.4: Advantages of ICT in Education

Increased access is another important benefit of ICT. Digital learning platforms and other online resources democratize education by exposing

learning materials to a broader audience. Content-reach Students in remote or disadvantaged areas can receive quality educational content without large-scale physical infrastructure. E-learning systems, open educational resources and MOOCs are representative of how ICT expands learning opportunities outside classrooms. Additionally, assistive technologies such as voice output systems, speech recognition technology and adaptive learning interfaces are now bringing disabled students higher level access to education ensuring accessible content and reducing barriers for all. So accessibility isn't just a convenience thing it's a solution for equity and inclusion in education.

Engagement is an additional aspect to consider when discussing ICT in education. Digital media formats engage students in the interactive and gamified learning, leading to student motivation to participate in educational work. Platforms with quizzes, discussion fora and joint projects promote involvement and peer learning. Moreover, ICT supports personalization of learning since adaptive systems evaluate student performance and generate feedback and resources tailored to individual needs. This customization fosters student independence, independent learning and responsibility ultimately resulting in better school success. Furthermore, ICT enables collaboration and communication inside the classroom as well as transnationally, bringing students in contact with global peers, teachers and experts on a real-time basis. Taken together, these advantages highlight ICT's contribution to the efficiency, effectiveness and democratization of education today.

1.2.3 Limitations of ICT in Education: Digital Divide, Infrastructure Challenges

Notwithstanding the many advantages of ICT in education, there are considerable restrictions on this integration which may limit its benefits and equitable access. Of particular concern is the digital divide, or the gaps between students and teachers in access to technology and digital tools. Socioeconomic conditions, geographical location and institutional resources result in inequality of access to computers, reliable internet and educational software. Learners from less privileged or rural settings might be simply deprived of the equipment, digital skills or bandwith, so they are denied a fair access to learn. The digital divide exacerbates already existing educational disparities and undercuts the potential for ICT as a tool for inclusive learning.

ICT (Information and Communication Technology)

Figure 1.5: Limitations of ICT in Education

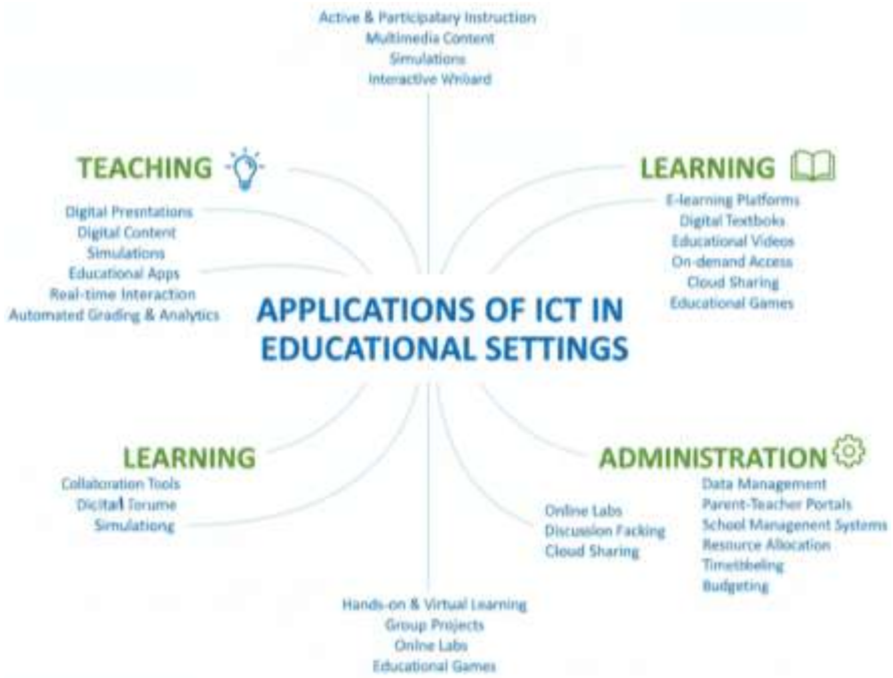
Infrastructure problems limit the effective utilization of ICT in educational environments. To establish and maintain digital infrastructure such as computer labs, high-speed internet connectivity, servers, technical support mechanisms costs significant money. A great deal of schools including post-secondary institutions in many countries find difficulties related to budget shortages, lack of technical support causing under use and ineffective use of ICTs. Moreover, regular electricity black outs, outdated equipment and software incompatibility create practical barriers for the integration of ICT. Even when resources are available, a low level of education and training for educators and staff can be a barrier to the successful integration of ICT into teaching and learning. Teachers who are not digitally literate and confident may continue to depend on traditional ways, resulting in the lost transformative possibilities of ICT.

In addition, there are pedagogical and cultural constraints in the use of ICT. The presence of digital tools alone does not ensure an enhanced learning experience; purposeful integration demands systematic instructional design, a curricular focus and ongoing professional development for teachers. Resistance to change, cultural attitudes toward technology and lack of institutional support motivates challenges which are a deterrent for the adoption of ICT integrated teaching. These constraints suggest the importance of holistic strategies focusing not only on technology provision, but also on training, policy and equity dimensions that need to be mediated in order that ICT can deliver its educational potential.

1.2.4 Applications of ICT in Educational Settings: Teaching, Learning, and Administration

Adoption of ICT in education covers teaching, learning and administration indicating the flexibility of digital tools in improving educational practices. For education, ICT allows new forms of instruction that are active and participatory. Educators employ, digital presentations, multimedia content and simulations to explain the key concepts in an interesting way. Real time interactive platform like interactive whiteboard, educational apps and virtual classroom allows real time interaction between a teacher and pupil, peer to peer and pupil to service center. In addition, ICT facilitates personalized learning that allows student works to be carried out on their own speed and adapted to individual proficiency. Online assignments and quizzes are automatically graded with analytics to help instructors gain insights into student performance and learning gaps.

In the field of education, ICT puts students in charge of their learning. E-learning websites, digital textbooks and educational videos allow learners instant and convenient access to learning materials outside the classroom walls. Collaboration tools, such as class discussion forums, group projects and cloud document sharing promote teamwork and peer learning. Furthermore, ICT facilitates hands-on and virtual learning through online labs, simulations, and games that encourage learners to explore (to try), experiment (apply their knowledge) in safe or programmed situations. Adaptive learning technologies even give additional personalization to education by using data on how students are performing, in order to suggest targeted material, thus increasing both the efficiency and efficacy of what is learned."



ICT (Information and Communication Technology)

Figure 1.6: Applications of ICT in Educational Settings

Administratively, ICT facilitates management and operational effectiveness in the school. The student’s attendance, scholastic records and the result of examination is also stored in digital record-keeping systems to minimize human work being done and to decrease chances of errors. Communication platforms provide a direct way for teachers, students and parents to communicate, promoting transparency and cooperation. Resource management systems monitor the inventories, budgets and schedules of institutions. Further, at the district and national levels ICT was used to manage policy implementation, monitoring, and reporting contributing to evidence-informed decision-making in education planning. Generally, the uses of ICT in instruction, learning and administration highlight its centrality to transforming education systems and performance.

1.2.5 Limitations of ICT Applications: Technical, Pedagogical, and Social Barriers

Notwithstanding the prospects of ICT there are technical, pedagogical and social challenges for its introduction into education. Technical obstacles are consist of hardware and software problem, network instability and inadequate technical assistance. When the system breaks down frequently, gets stuck with

software issues or jeopardizes privacy, learning is disrupted and confidence in technology can be eroded. Teachers and students may encounter trouble in problem solving technical issues, resulting frustration and low motivation. In addition, educational institutes face cost and logistical challenges due to the constant need for adaptations and updates in a fast-evolving world of technology. Pedagogical hindrances emerge when ICT is employed in a trivial fashion wherein such implementation does not lead to desired educational outcomes. Simply putting digital tools in the classroom won't make students learn better. The integration of ICT with impact Requires pedagogy approaches that Delves the critical thinking, problem-solving and active learning. Inadequate teacher training, poor knowledge in digital pedagogy and dependence on conventional teaching methods stifle the transformative potential of ICT to impact learning. Secondly, the quality of content and alignment to curriculum is critical as poorly developed or irrelevant digital assets can not only fail to enhance understanding and engagement but may impede it.

In addition, the incentives and artificial sociocultural barriers that affect succeeding in using ICT are important. Since the resources needed to establish progress individually over time rely on public authorities, they should be considered carefully. Among them are resistance to change on the part of teachers, students and parents and a culture around technology use and learning. Excessive reliance on digital tools can result in less face-to-face interaction, social isolation, and underdeveloped social skills. Further, issues relating to data protection and the ethics of ICT use in education, concerns over screen time and access to technology of acceptable quality affect uptake and persistence of ITC based projects. Responding to these issues involves integrated policy implementation, ongoing professional development, community involvement and ethical dimensions for ICT to make a significant contribution towards enhancing education.

1.3 Self-Assessment Questions

1.3.1 Multiple Choice Questions (MCQs)

1. **ICT stands for:**

   a) International Computer Technology

   b) Information and Communication Technology

   c) Internet and Computing Technology

   d) Integrated Communication Tools

2. **Which of the following is NOT an advantage of ICT in education?**

   a) Enhanced accessibility to learning resources

   b) Increased student engagement

   c) Complete replacement of teachers

   d) Personalized learning opportunities

3. **The origin of ICT can be traced back to:**

   a) The invention of computers in the 1940s

   b) The development of telegraph and telephone

   c) The creation of the internet in the 1990s

   d) The launch of smartphones in the 2000s

4. **One major limitation of ICT in education is:**

   a) Improved communication

   b) Digital divide and unequal access

   c) Enhanced collaboration

   d) Better information storage

5. **ICT in education primarily aims to:**

   a) Replace traditional teaching methods entirely

   b) Enhance teaching-learning processes and outcomes

   c) Eliminate the need for textbooks

   d) Reduce teacher workload only

6. **The growth phase of ICT represents:**

   a) From mainframes to personal computers to mobile devices

   b) Only the development of the internet

   c) Exclusive focus on hardware development

   d) Decline in technological innovation

7. **An application of ICT in education includes:**

   a) Only teaching

   b) Teaching, learning, assessment, and administration

   c) Entertainment purposes

   d) None of the above

8. **The nature of ICT is characterized by:**

   a) Stability and uniformity

   b) Rapid evolution and convergence of technologies

   c) Limited innovation

   d) Isolation of technologies

9. **A major challenge in implementing ICT in education is:**

   a) Teacher interest

   b) Student resistance

   c) Infrastructure and resource constraints

   d) Curriculum design

10. **The concept of ICT encompasses:**

   a) Only computer hardware

   b) Integration of telecommunications, computers, and information systems

   c) Software development only

   d) Data storage devices

1.3.2 Short Answer Questions

1. Define Information and Communication Technology (ICT) and state its key characteristics.
2. Explain any three advantages of using ICT in educational settings.
3. Trace briefly the origin and early development of ICT.
4. What are the major limitations of ICT application in education?
5. Differentiate between the uses and limitations of ICT in teaching-learning processes.

1.3.3 Long Answer Questions

1. Discuss the concept and nature of ICT. How has it evolved over time?
2. Critically analyze the advantages and limitations of ICT in education with examples.

3. Trace the development of ICT from its origin to its current growth. Identify key milestones.
4. Elaborate on various applications of ICT in education. Discuss both uses and limitations.
5. Evaluate the role of ICT in transforming educational practices. Suggest ways educators can overcome its limitations.

MODULE 2
MEANING, SCOPE, AND COMPONENTS OF EDUCATIONAL TECHNOLOGY

STRUCTURE

2.0 OBJECTIVE

- Define and comprehend the meaning and scope of educational technology.
- Analyze educational technology as a systematic approach.
- Understand the characteristics of educational technology as a system.
- Identify hardware and software components of educational technology.
- Distinguish between educational and instructional technology.
- Examine the interrelationship among various components.

2.1.1 Meaning and Definition of Educational Technology

Educational technologies are a complex and dynamic field which has in turn affected the landscape of teaching and learning in large number of educational systems. At its heart, educational technology is much more than using computers in classrooms, or projectors for that matter. It is a strategy that includes all the processes of design, development, implementation and evaluation for the whole learning-teaching system including human and no-human resources to maximize educational output and improve learning conditions. Educational technology Definitions Existing definitions of educational technology have included varying concepts and concerns ever since the field first emerged as a specialized branch of education and developed as a new dimension of an interdisciplinary field. The Association for Educational Communications and Technology (AECT) has historically offered several key definitions that have guided our understanding of the field. Educational technology is defined in various ways as, the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources.

This definition focuses not on the tools, but rather on how they are used to intentionally and meaningfully changed education.

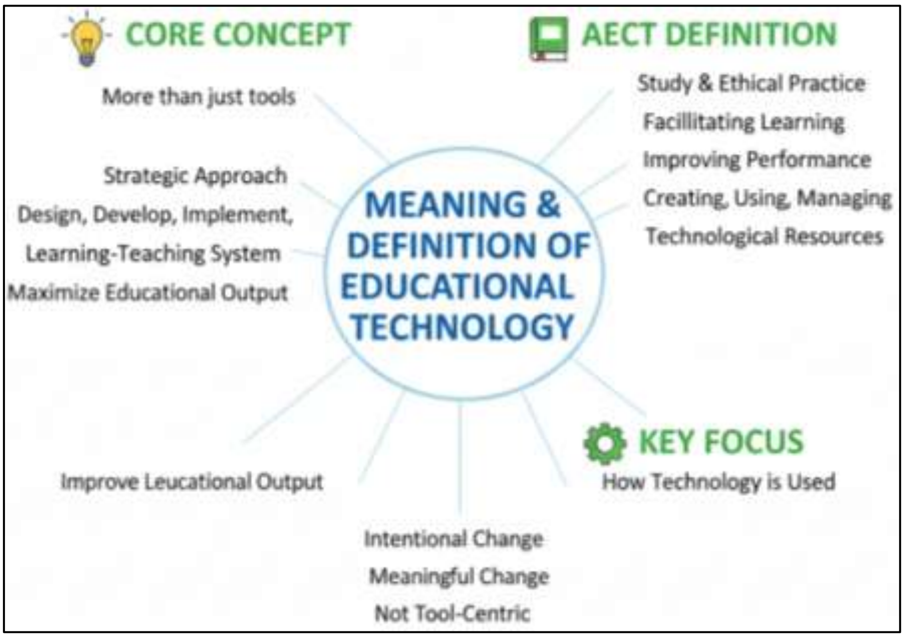


Figure 2.1: Meaning and Definition of Educational Technology

Learning tools can be viewed through several different perspectives. On the hardware side, this incorporates all manner of tech tools found in schools, whether outdated (the overhead projector and portable TV were tech at one point) or modern (like interactive whiteboards, tablets, virtual reality headsets), digital equipment from which educational experiences are built. Yet, this device-centric perspective is not the only aspect of educational technology. The software dimension includes the multitude programs, applications education content creation for teaching and learning. (e.g., educational software, e-learning platforms multimedia courseware) and digital learning objects. Educational technology is more than these physical and virtual tools, more than a systems approach to education. From this perspective the term educational technology reflects the use of scientific knowledge to conduct teaching and instruction. It includes the systematic design of instruction, the development of instructional materials, and learning experiences, as well as course development processes and the implementation and evaluation of educational programs. This broader focus on educational technology is predicated on the notion that education is finally about imparting knowledge, either quality or facts, as well as about motivation and methodology. There are certain key principles upon which the philosophy of educational technology is based. First of all, it acknowledges that education is a complicated enterprise; it needs planning and organizational Everyone Has Designs on Us effort. Second, it recognises that learning is a science - with principles that can be studied, understood and utilised to enable more effective educational experiences. Third, it underscores the need for evidence-based practice, meaning that educational decisions should be based on research and other empirical findings rather than intuition. Fourth, it encourages the belief that instruction can and should be constructed intentionally in order to facilitate particular learning outcomes rather than randomly occurring.

Problem-based education is also representative of educational technology. It starts with an clear identification of educational problems or learning needs and achieving improvement through a logical application of knowledge, techniques and resources. This could include, for example, examining the learner's characteristics, articulating achievable learning objectives, determining suitable teaching methods and materials to use in teaching or guidance and applying instructional methods. Psychologists, communicators, systems theorists, computer scientists and instructional designers contributed to the foundation of knowledge in this field.

2.1.2 Scope: Instructional Design, Curriculum Development, Evaluation

Educational technology encompasses numerous fields that are situated at the intersection of teaching, learning, and technology (Batista, 2010), but three primary areas where it can be applied with great impact include instructional design, curriculum development, and evaluation. These eight categories of interrelated dimensions illustrate the scope of ET's impact on schooling, at the same time, however they also show how the field can tackle different components that are part of the continuum of teaching-learning. Instructional design is the foundation of educational technology and is, by description, the act of making instructional/learning resources for learners to facilitate the process of learning in effective way. The field of practice that uses learning and instructional theory as a basis to design educational materials and activities. The design of instruction, a process with several stages, should start with an analysis of learner characteristics and competencies, learning needs, as well as the instructional environment. Designers need to know who their learners are, what they bring to the learning situation in terms of knowledge (who needs this knowledge is referred to as learners or users), what they must learn, and within which context. It is very important design phase because it defines all future choices in the design cycle. After analysis, instructional designers get to the design phase in which delivery methods are devised and learning objectives are stated clearly. Instructional objectives which state what the students will be able to do after instruction, giving explicit targets of teaching and testing. Design also encompasses choices about sequencing content or instruction, media and technology selection, and the instructional approach. Designers are expected to think about the different theories and models of instruction behaviorist, cognitivist, and constructivist plucking strategies that “fit” with what they want learners to do and be attentive to enrollment characteristics.

In the development phase, instructional materials are created in real. Time whether hardcopy text or graphics to be printed or displayed on a screen passive audio/ visual presentations (lecturettes) digitally based learning modules interactive multimedia simulations. This stage is a team effort between experts in the target field, instructional designers, graphic designers, programmers and media producers. Quality of materials created in this stage influences to a great extent how instructional effectiveness tests are designed, so attentiveness to detail, usability and pedagogical soundness here is crucial. Execution takes the planned instruction to students, which includes all the logistics necessary in addition to working closely with staff and resources. Finally, evaluation is conducted at each phase of the instructional design, which focuses on evaluating the quality of the materials as well as determining whether or not that translates into success with learning. This cycle of iterations permits ongoing data- and feedback-driven enhancements.

Another important component of educational technology development is the building of curriculum. Whereas instructional design tends to concentrate on individual learning experiences or courses, curriculum development deals with an entire educational program including the planning and organization of content across several courses or a whole program. Curriculum is largely informed by educational technology, which offers models, techniques, and strategies for the design of coherent and effective curricula in order to meet the needs of society, the learning styles of students as well as educational objectives. Educational technology in curriculum development provides an organized way to look at what is to be taught, why it needs to be taught this way and how the materials need to be arranged. This includes carrying out needs assessments to determine the gap between current educational attainment and desired levels, analyzing social demands and workforce needs, as well as considering… developmental appropriateness of content for diverse age groups and educational levels. Technology can also enable curriculum mapping so that educators can see how learning restrains through grade levels and relate with other topics.

Curriculum design in online and blended learning contexts with the development of new educational technology, curriculum design has broadened possibilities for curricula that are more flexible and personalizable both to fit personalized learners' needs and paces. On digital platforms, it is possible to combine different multimedia resources, interactive tasks and authentic learning activities that would be unfeasible or of outreach in traditional curricula. Technology also supports competency- or mastery-based curricular models in which students move forward according to what they know rather than how much time they spend studying, a substantial departure from traditional curricular design. The third area, evaluation, concerns the application of procedures for making systematic judgments about education programs, materials and processes based on the systems collection, analysis and interpretation of information enabling educators to make informed decisions regarding their quality and effectiveness. Educational technology has brought significant advances in evaluation, offering ideas and tools of formative (evaluation during the course of development and implementation to guide improvement) and summative (judging overall effectiveness or outcomes) evaluation.

Technology makes it possible to gather a wealth of data about learning, from test scores and behavioral observations, to portfolio artifacts, performance assessment ratings, and learning analytics generated in digital learning environments. In fact, learning analytics is one of the most promising applications of educational technology to evaluation, providing real-time monitoring of learners and enabling teachers to detect struggling students early and personalize interventions. These include monitoring usage of learning materials, time on task, errors, and learning paths; all adding up to deeper insight that can inform both instructional and programmatic decisions.

While many questions about evaluation in educational technology pertain to assessment of individual performance and curricular impact, assessment within the field considers the measure of technology itself that is, whether certain tools or platforms or an approach supports learning objectives and represents a good outlay of resources. These can range from usability tests, through effectiveness studies, to cost/benefit type analysis and how learners with differing learning needs interact with technology. The levels of evaluation can range from the assessment of an individual learner the contextual, programmatic and system-wide levels, and this is likely to call for a range of methods and instruments suitable for each level (Estabrooks et al., 2007).

2.1.3 Educational Technology as a System: Inputs, Processes, Outputs, Feedback

Educational technology as a system It is a useful way of conceiving the elements that are interrelated and how they work together in order to accomplish educational objectives. The systems approach, based on general systems theory, does not consider educational technology as a series of isolated tools or techniques but as an entire system in which multiple elements interact dynamically to produce outcomes. This approach highlights the interrelationships between its elements, acknowledging that changes in one part have implications for others and necessitating consideration of educational design and context. The systems approach to educational technology lists these four components:

I.) input,

II.) process,

III.) output

IV.) Feedback.

Inputs include everything from all of the resources, materials, and conditions that go into the system itself on which teaching and learning take place. These inputs are various and multifold including human material such as learners who possess their special traits, previous experiences, learning styles, motivations and individual differences. Another significant human input includes teachers and instructional facilitators who can use their expertise, pedagogical contents, teaching methods and facilitation skills in education.

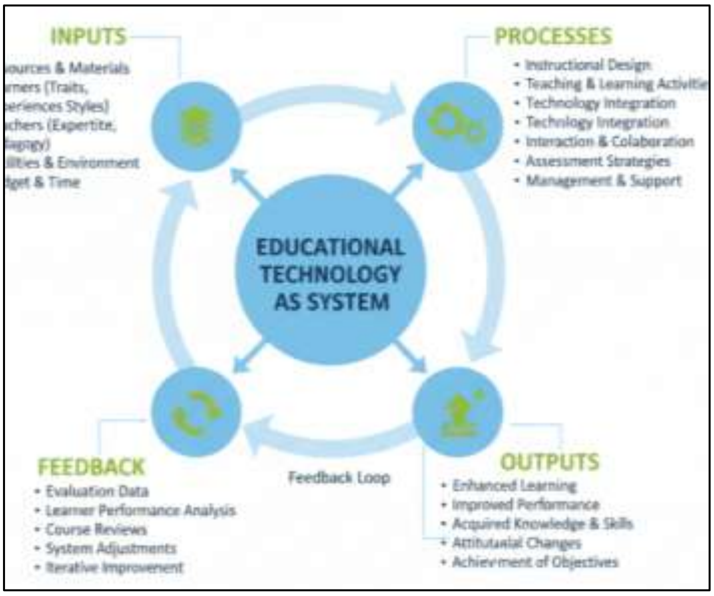


Figure 2.2: Educational Technology as a System: Inputs, Processes, Outputs, Feedback

Another important input is money, It will, to a large extent, decide what technologies may be purchased, what materials might be developed and what operations can be carried out. Time is another key factor, with both learners and teachers needing the time to interact with content, practice skills, and make sense of learning. Quality and quantity of these various inputs have great influence on what can be achieved within the educational system, so attention to details in making inputs an important consideration for implementation of educational technology. Processes are the dynamic core of the system, reflecting all such activities, interactions and transformations that take place when an input is used for the purpose of bringing about learning. The learning process consists of the ways in which teacher's help students acquire content, engage with learners, provide practice opportunities and assess learner performance. These could include direct instruction and demonstration, inquiry-led learning, collaborative learning projects, problem-solving tasks or experiential learning. Choice of Instructional Strategies The selection of suitable instruction processes depends on objectives for learning, learners' characteristics, nature of content and type of resources at the disposal.

Processes of learning take place in students when interacting with content and activities as they develop an understanding, acquire skills, and cultivate a mindset. These, in turn, are processes of attention perception encoding storage retrieval problem-solving critical thinking and meta-cognition. Educational technology seeks to develop these natural processes through developing a carefully created learning experiences and using the appropriate media and tools. Administrative activities consist of all processes that have to do with organizing and planning resources, scheduling events, managing facilities, helping users or maintaining the operational integrity of an educational system.

Communication processes are basic within educational technology as they facilitate the transfer of information between learners and teachers, between learners themselves, and among learners and instructional materials. These processes have been changed by the digital transformation which includes synchronous and asynchronous communication, multimedia presentation of information, and as well interactive conversation with smart systems. Assessment, central to the system, consists of collecting evidence of learning through techniques such as tests or observations or performances or portfolios, and then interpreting this evidence to determine judgments about learner accomplishment and instructional efficacy. Outputs are the former, or conversions of input into output by the product system. The primary outcomes are educational results: what learners know and can do, their attitudes, values,

and beliefs, as well as competencies. These results should be consistent with pre-established learning objectives and can be cognitive (learning concepts or remembering information), psychomotor (skills used to move or manipulate something) or affective (attaching value to something). Large system outcomes go beyond individual-level learning, and include the production of Completed projects (Artifacts), solved problems, demonstrated performances to show evidence of learning. Graduates are another type of output, as such personnel have completed a course and are now ready to continue in higher education or in the jobs market. More broadly, outcomes include benefits to society such as an educated public, a prepared workforce, cultural and social advancement and social mobility. Not all results are positive, however, as unintended negative outcomes (e.g., learner frustration, technological overreliance, or inequitable access) need to be identified and navigated.

Feedback is a key method that the educational system in general, and its technology in particular, uses to monitor itself and make necessary adjustments for improved performance. Feedback loops mean that the outputs are feedback to themselves as inputs and processes which makes the whole system to be able to self-organise and it is continually improving. Immediate feedback is that which a learner receives while being taught errors and discrepancies may be pointed out by the teacher, as well as any misconceptions held. This could be from teachers, classmates or automated systems in education software. Formative feedback happens during a course or program, offering continuous data on how students are doing and the effectiveness of their instruction. This allows teachers to tailor teaching tactics, change the pace of instruction, reinforce (or re-teach) as necessary and verify that students are progressing towards goals. Terminal feedback is delivered at the conclusion of an instructional unit or program to report on overall accomplishment and success of the program. This information is used to make decisions regarding the progression of learners' achievement, continued or revised program implementation, and allocation of resources.

System-level feedback includes measures on overall program performance, resource utilization, efficiency and effectiveness, and organizational performance. Such feedback is used for planning and to make policy decisions, as well as for macro-improvements at the national level.

The existence of effective feedback mechanisms parallels the concept that educational technology, as a system can be described in this way rather than by listing several independent activities, is responsive and capable for continuous improvement and modification relative to the evolving needs of humans and environment.

2.1.4 Characteristics: Systematic, Scientific, Practical

As a field and practice, the use of educational technology has several defining features that influence the way it approaches teaching and learning. There are 3 main features systematic, scientific, and praxiologic that constitute the core of educational technology as an agent applying it in charge of educational issues. These features are informative in explaining what distinguishes educational technology from education that is either not planned or only loosely organized, and why it has experienced a growing influence especially in modern day teaching and learning. If I were to pick an educational technology hallmark, it would be convenience. Being systematic is to address educational issues in terms of organized, methodical and logical ways rather than by trial, intuition. Educational technology uses scientific procedures for problem analysis, design of solutions, implementation and evaluation. This systematic approach is reflected in the instructional design models such as ADDIE where it offers a step-by-step systematic framework to lead the designer to go through from Analysis, Design, Development, Implementation and Evaluation stages logically.

Systemic means that not only is the educational technology organization itself considered, but also its interdependent context and educational processes as part of a system. It acknowledges that teaching and learning do not take place in a vacuum but take place within complicated systems comprised of the learner, teacher, subject matter, resources, environment, and larger social context. A systems approach must be carefully orchestrated at multiple levels taking into considerations all these variables and their interactions. For instance, in the case of a new educational technology, it would not focus on the technology as an end itself rather teacher training needs, infrastructure demands, how curriculum needs to be aligned and changed for assessments

and change management techniques.

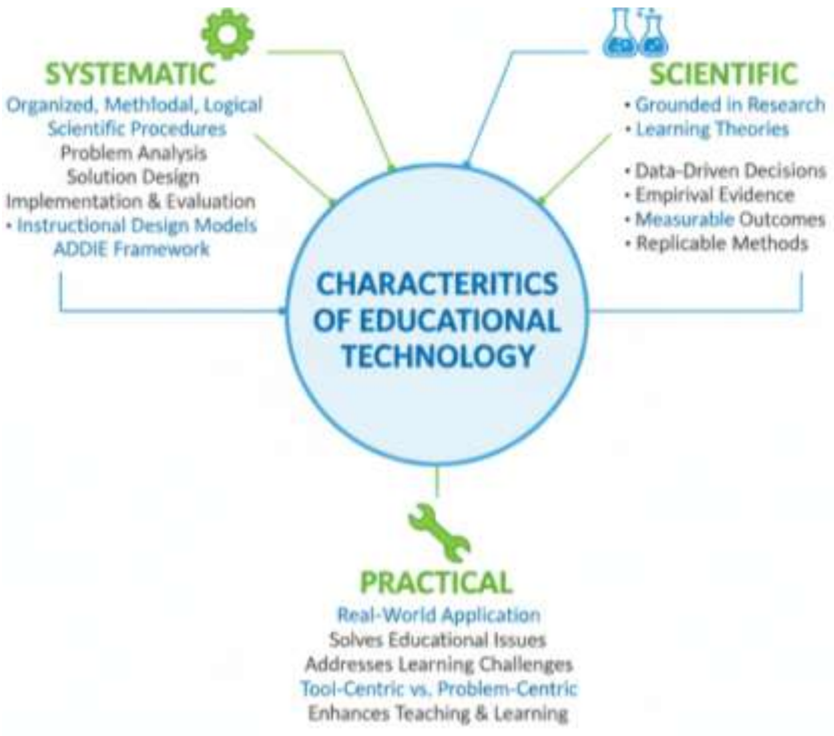


Figure 2.3: Characteristics of educational technology

Consistency and reliability is also implied in the systematic character of educational technology. Transparent processes can be described, shared and repeated by others, propagating best practice and scaling impact. This is a departure from idiosyncratic teaching methods based solely on teacher intuition that are not necessarily repeatable in other classroom contexts. Systematic practices establish system and protocol that could work for many workers while there is room for flexibility based on each particular circumstance.

Also, to be systematic implies pursuing specific objectives by deliberate steps. This use of educational technology shifts the focus from the system itself, to the learning goals i.e. it designs task prior leading all other activities following those tasks. This guarantees consistency among the goal, that which is taught, and what is tested. The systematic aspect also includes constant surveillance and correction it looks at education as an engineer does, as a phenomenon that is capable of being perennially perfected through methodical readjustment based on evidence.

The science of educational technology is based on research, evidence and well-founded principles of learning and teaching. Educational technology yearns to be more than an art of practice responsive only to experience and intuition, it would like to become a science informed through systematic study of what works, why it works, for whom and under what conditions. This scientific attitude is expressed in several ways at every level of the discipline. First, educational technology is deeply nested and can tap into a scientific basis of knowledge from human psychology, cognitive science, and brain science and communication theory to inform its practice. Theories of how people learn behaviorism, cognitivist, constructivism, and connectives are scientific ways to describe learning processes and provide a framework for understanding learning on multiple levels (virtual/physical environments) and scales (individuals/society). For example, Cognitive Load Theory (CLT) is a scientific theory of teaching based on our understanding of human memory and information processing to help design instruction that does not exceed the cognitive capacity of learners. The scientific nature also implies that educational technology prioritizes empirical evidence above opinion or tradition. Allegations of the effectiveness of instruction are to be underwired by systematic scrutiny on whether they stand up to good research. This could be intervention research testing instructional interventions, correlational research empirically relating variables to one another, or qualitative inquiry into the experiences of learners. Evidence-based practice: By focusing on evidence-based practice, this means that decisions about educational technology should be based on what the research says does work rather than what sounds like a good idea or has always been done.

It is the science of using technology to design or improve learning. The collection, organization, and interpretation of data on learning outcomes, teaching processes, and program efficacy is a rational form of empirical inquiry into the nature and impact of education. For instance, learning analytics applies data science techniques to educational data, revealing patterns and relationships that can be used to support instructional design decisions. Formative assessment can be seen as a kind of action research in that teachers systematically collect evidence about learning from students and use this information to inform their teaching.

Human factor and acceptance of educational technology Should education become 'scientific' it must be noted that, though the scientific nature may serve as part of the definition of educational technology, real-life teaching and learning entail human agents and intervention within society; predicting with mathematical models is not always possible outside physical sciences. Educational technology accepts the shortcomings of science and stresses adherence to evidence-based practice, systematic inquiry and grounding in research.

The pragmatic nature of educational technology While applied is focused on real problems to solve instructionally. Educational technology is not just an academic subject area that you study to learn what we know for the sake of knowledge; it's a discipline that aims to make things better in real educational contexts. This applied focus separates educational technology from pure research disciplines such as computer science and psychology, and explains the priorities, methods, practices and values of the field. In practical terms, education technology has to work in the real world: under time constraints, with available resources and expertise and on infrastructure that is not necessarily as high-end connected. Solutions also have to be practicable and durable, not merely academically respectable. An ID (Instructional design) can have a lot of pedagogical sophistication and not work if it needs to be staffed by teachers that don’t exist, with technology schools cannot buy or that time schedules will never allow. Education technology practitioners need to reconcile theoretical solutions with what is feasible, and try to map out something that falls short of perfection but hits some important targets.

The most obvious feature is one of practicality (so tuned in to the concept of usability and the user experience). Educational technology needs to be available and usable by all teachers and learners, regardless of their technical proficiency. These practical concerns are represented in user-centered design methods, which highlight the value of iterative testing with real users and continual improvement based on input from them. If a learning management system is so cumbersome that teachers can't use it or educational software makes students angry, no matter how practically effective they may be in theory, these tools won't work.

This practicability includes cost efficiency and scalability. Education technology should be value driven, an investment that substantially improves the learning for the cost you spend in money, time and labor. Good innovations should also be scalable, able to grow from small pilots to scale implementation. This includes being mindful of things such as infrastructure, staff development, and change management.

Being practical does not relegate you from being rigorous or settling for mediocrity. What it does mature, however, is the sense that educational technology is rooted in a practice-oriented struggle for authentic pedagogical change. Theory and research are useful only to the extent that they contribute to practical improvement. The glory of educational technology, the proof it can work magic, isn’t whether its parts are elegant; it’s if helps learners learn better. This pragmatic approach helps keep educational technology grounded and focused on its core mission of making education better.

2.1.5 Evolution of Educational Technology as a Discipline

The development of detach as a unique field is an intriguing journey that covers over a hundred years and demonstrates the overall shift in technology, psychology, education, and society. To get a sense of this evolutionary trajectory is important as context for contemporary ed tech practices, and for when trying to guess what may come. The field has gone through several distinct periods, which reflexively build on existing trends and issues while also adding novel emphases and possibilities.

The first development of educational technology as a specialized field preceded the in late 19th century, with some early research on classes and teaching machines appearing in the major period of impact began in the when people trying to teach using media became involved in analysis. The visual instruction movement arose at about this time, arguing for the benefit of incorporating photographs, diagrams, museum objects and finally films into education. Supporters of visual materials claimed that they made abstract ideas concrete, brought scenes in distant places and times into schools, and reinforced understanding through several senses.

This was a precursor to an early realization that learning could be enriched through thoughtful application of media and materials beyond the standard textbook and lecture.

The advent of radio and sound film in the 1920s and 1930s led to increasingly widespread use of audiovisual aids. Colleges and universities established audiovisual departments to obtain, organize and distribute such materials. This era also saw the beginning of evaluations concerning audiovisual materials, as science (as it then existed) was for the first time brought to bear on questions regarding instructional media. The audiovisual education movement had its roots in advocating that learning is enriched through concrete experience supported by progressive education philosophy of John Dewey, and the "Cone of Experience" as articulated by Edgar Dale, demonstrating this correlation between sense involvements with increasing degrees of abstraction.

Educational technology during World War II was indicative of educational technology's development and continued importance. The scale of the training requirements for military personnel millions of people who had to learn complex things in not much time meant there were pressures to find ways to teach more Read, 'aace hits/Thornburg 69 bag galey powerfully but with less investment in overhead. Psychologists and educators worked together to create such mass training programs, using behavioral psychology to develop a systematic form of instruction. Training films, simulators and programed instruction were produced and extensively tested. These successful military training programmes provided evidence that the systematic application of principles of learning, and the appropriate use of media could greatly enhance instructional efficiency.

After WWII, there was an explosion of interest in the transfer and transferability of what military training had learned about men to civilian education. The audiovisual education "rush" was on, and schools were heavily equipped with media centers and materials. Nonetheless, for all the excitement and expenditure, research conducted in the 1950s and 1960s typically reported no reliable advantage of media-based instruction over its traditional form. Such "no significant difference" results have helped change opinions about educational technology. The movement to a more diverse and inclusive technology in the 1960s began with the development of multimedia as an educational technology. This change was due to the increasing understanding of technology's effectiveness not being due so much from the medium itself but from how instruction was designed. Building upon systems theory and programmed instruction, systems approach began to become popular as a systematic models of instructional design, development, and evaluation evolved in educational technology. B.F. Skinner's work on programmed instruction showed that well-sequenced teaching with prompt feedback could aid learning, and Robert Gagné's conditions of learning gave insight into how to design instruction around various kinds of learning outcomes.

It was also during this time, however, that educational technology as an academic field began to come into its own with programs such as the Purdue University School of Technology becoming a founding member of ISPI in 1962 and some the University of Florida which organized a group called the "Educational Technology Organization" in 1967. The discipline grew to include areas such as curriculum development, instructional design, program evaluation, and educational research, rather than focusing solely on media production and distribution. This broader definition of EDUTECH was well represent by the 1963 defining statement, created by the Commission on Instructional Technology, the use of a systematic way of designing, carrying out and evaluating the total process of learning and teaching in terms Fickbury & Schlarnanski Page I410 rations for current theorizing about instructional designers from research based findings.

The 1960s and 1970s saw computers being introduced to education offering a new way of doing things. Early computer-assisted instruction programs, as primitive as they were given the state of the art technology at the time, showed promise for individualized instruction, immediate feedback, record-keeping and interactive learning experiences that could not be replicated with other media. With the advent of increasingly powerful and accessible computers through the 1980s and 1990s, computer-based training incorporated multimedia technologies with capabilities such as simulations, games, networking and educational content.

The cognitive revolution in psychology during the 1970s and 1980s had a major influence on the development of software and theory applied to education, and led to the desktop metaphor. Perhaps the most significant contribution is that of J.C.R. Licklider, whose research from 1960 around not only human–computer interaction, but also inter-human interaction, predicted many of the challenges in implementing educational technology decades before other researchers. Beyond the behaviorist preoccupation with behavior that was observable, cognitive psychology became concerned with learning, memory, problem solving and metacognition. This change pushed educational technologists to create instruction that facilitated cognitive processes, minimized the cognitive load, fostered meaningful learning and developed higher-order thinking. Cognitive psychology principles such as information processing, schema, and cognitive load theory also had a profound effect on ISSD.

The decade of the 1990s introduced email and Web-based computing, quite likely the two most revolutionary technologies of educational technology's history. Some of the key areas of practice and research have been online learning or distance education, digital libraries, educational portals, educational networks and networked collaborative learning. The internet had pushed information into the hands of the masses, opening new channels for communication and collaboration that spanned time and space. Constructivist theories of learning, which focused on learners' active construction of knowledge and learning as a social process, became better understood at this time and shaped the design of online environments that fostered collaboration, inquiry and authentic problem-based learning. At the start of the twenty-first century there had been rapid technological change and digital technologies have become more pervasive across education. Recent advances include the proliferation of mobile devises, cloud computing, social media, learning analytics, artificial intelligence, virtual and augmented reality, and adaptive education systems.

Unit 2.2: Components of Educational Technology

2.2.1 Overview of Components

Educational technology is regarded as an integrated system which includes inter-related component parts to present a unified effort in achieving optimal teaching and learning experiences. The essentials of educational technology consist of two basic aspects: hardware, the physical devices used for instruction, and software, computer programs or applications that support teaching and learning. Comprehending these components and their relationships is important for educators, administrators and technologists attempting to create sound technology-based learning environments. The educational technology landscape has changed dramatically over the last several decades, moving from primitive computer assisted instruction tools to complex interconnected systems that can accommodate multiple modes of learning. They are not standalone units but a connected system that requires the cooperation of all components to form prior meaning educational experiences. The hardware gives that form of physical infrastructure and actual tools which students and teachers can touch, software on the other hand offers content, applications and programs that give the impetus to educational activities.

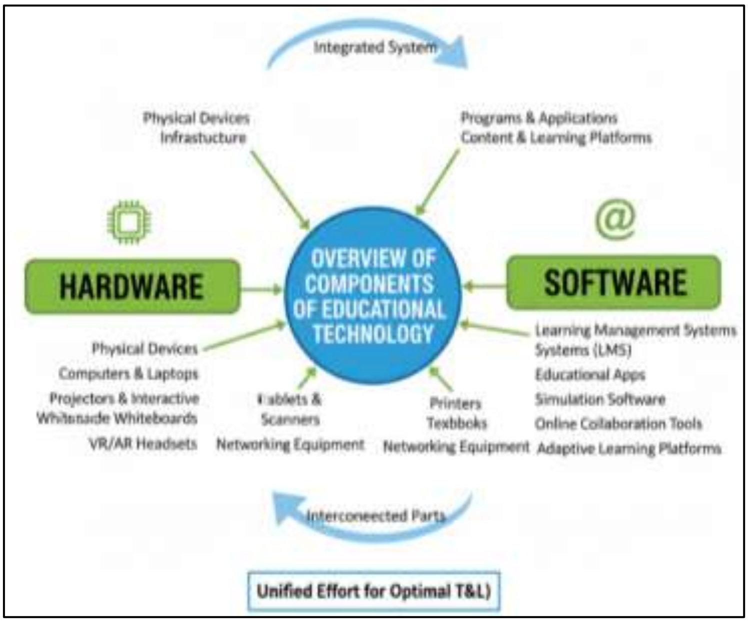


Figure 2.4: Overview of Components

In addition to the elementary hardware-software identification, educational technology also comprises learning material that can be added to or extracted from digital systems as needed as well as of networking infrastructure. These include devices and auxiliary equipment (such a battery), which are specifically used at the side of primary device.in a supporting role. Each is essential to keep technology serving its purpose in education: facilitating and enhancing the learning experience. Quality, compatibility and interactivity of these various components determines how effective is the implementation of educational technologies.

Moreover, the theoretical framework of educational technology can be considered more than just physical and digital resources to include pedagogical techniques, instructional design principles, and use hereof. This broad perspective underscores a focus on the way in which technology comprises critical building blocks (tools) that should be optimally chosen, configured and used for facilitating specific learning objectives or individual learner preferences. The relationship among these components builds a educational technology ecosystem which can provide for different learning types, and respond to various academic environments (for instance, the needs of mobile or classroom-based educating) as well as shifting pedagogical ends.

2.2.2 Hardware: Devices, Equipment, Infrastructure

The hardware is the concrete basis on which educational technology is based, it includes all material devices and installations and provides a digital learning experience. At the epoch, computer systems are, in essence, the major conduit of users to e-learning resources. These have become modulated and diversified, starting with desktop computers /laptops (TDs), followed by tablets and smartphones, and more recently interactive whiteboards/document cameras taking relevance as unique teaching devices. Each has its own benefits and educational functions at all stages. Desktop team: Powerful for big tasks, can do great mu; this is your school PC-Laptop team: ultra-portable, battery life of more than 10 hours-this is your personal secretary tablets: a notebook pc for kids; There's more fun with the touch Little fingers strongly suggest you use the DC5V/2A-3A power suppler note. Infrastructure in educational technology hardware infrastructure encompasses much more than devices, including networking equipment, servers and connectivity devices that connect networks and transmit information. Networks of local area networks and the switches, routers, access points are like an invisible spine tying all your devices together to connect with online resources, cloud-based applications or to a colleague. This infrastructure needs to be resilient, trustworthy and able to accommodate the band with requirements of hundreds/thousands of simultaneous users engaged in a range of activities, from streaming educational videos, videoconference sessions and accessing cloud-based learning management systems.

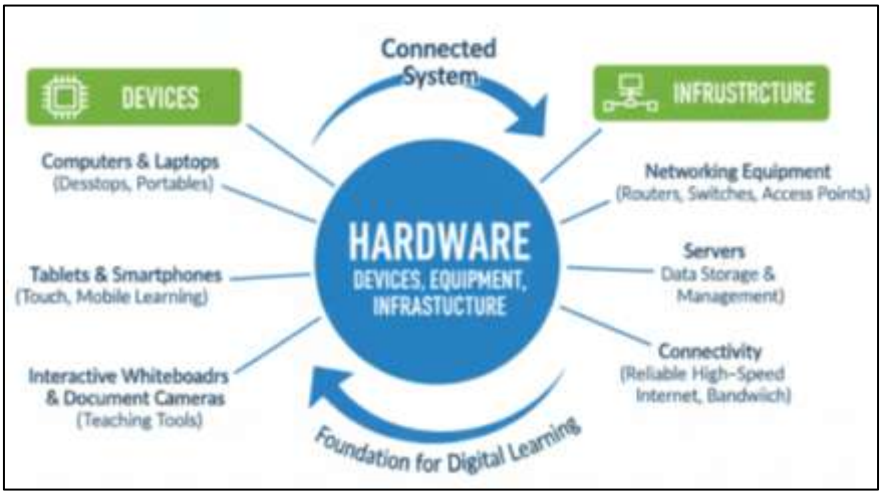


Figure 2.5: Hardware: Devices, Equipment, and Infrastructure

Another important category of educational hardware is display technology, and interactive whiteboards, projectors and large-format displays turn a skillfully delivered classroom lecture into something dynamic and engaging. Interactive whiteboards permit teachers to manipulate digital content on the screen, annotate lessons on-the-fly, and save these notes for future reference or distribution among students. These devices combine the best aspects of traditional instructor-led teaching with cutting edge digital technology, allowing educators to include multimedia content, dynamic and interactive

simulations as well as face-to-face tutoring in harmony with their familiar front-of-classroom teaching style. Peripherals and accessories add-on to the strength of core computing hardware, for example input devices like keyboards and mice; output devices such as monitors, printers, projectors and speakers; and to other equipment including audio system components. These accessories allow a variety of different interaction styles with digital content, moving from traditional written assignments and multimedia projects to conducting virtual discussions or recording presentations. The selection and deployment of suitable peripherals can have a large effect on the quality and variety of educational work students can perform.

Local and cloud-based storage infrastructure, as an important hardware infrastructure, has received little attention in educational technology ecosystems despite its significance. Local hard drives, solid state storage and network attached storage are integral to available access of files and applications as well as the ability to centrally manage education resources and student work. The trend of the importance has been shifting to cloud storage solutions, scalable-accessible-secure repository for learning content, student portfolio and administrative data. Deciding how to store your media Local vs Cloud and Pros Cons of each considerations are speed, reliability, security, cost, connectivity.

The educational technology physical infrastructure can comprise issues such as power, cooling and ventilation needs, furniture designs to accommodate equipment, ergonomics design considerations, physical security access control plans to the site among others. Sufficient electrical load and distribution is required to power numerous devices operating simultaneously, as well as correct cooling means less hot spots within the racks and helps provide a long equipment life. Ergonomic furniture, such as adjustable desks and chairs, monitor placement and lighting also adds to student comfort and well-being when using technology for longer periods of time. Physical security Implementations provided by locked storage cabinets, device tracking and surveillance equipment prevents from theft and prolong product's lifespan. Hardware designed for disabled students is a significant part of educational technology hardware. Through the use of assistive technology, such as screen readers, alternative input devices, adaptive keyboards and communication boards, hearing assistive systems; educational technology can continue to be readily accessible for all students even if they have been diagnosed with disabilities. Offering such specialized hardware shows your commitment to inclusive education and meeting the accessibility guidelines, and allows all students to take advantage of technology-enriched learning opportunities.

2.2.3 Software: Programs, Applications, Digital Content

Add value to the learner and teacher by extending their capabilities to explore learning content, participate in exercises and projects) Software Intellectual aspect of edtech ideally both use and create it (authoring tools), learning how it works Interactive. BEG, working hardware representations with very specific functions Includes programs, (Function or logic is defined SOFTWARE: The I-mind building component Illustrative Detail Use becomes a “Schizophrenic object “for learning Content: Operating systems are the core of the software that accesses hardware resources and offers an environment for programs to run. Regardless of whether its Windows, macOS, Chrome OS, iOS, Android or Linux the makes all the difference to what apps are available for a platform, the user interface style and what that device will be like to use. Schools will need to determine which operating system is the best fit; decisions hinge on software compatibility, faculty and staff familiarity, support needs, availability of security options and TCO.

Educational-specific application software covers a wide spectrum of tools and platforms every serving different learning functions. Learning management systems are comprehensive course organization platforms for content delivery, assignment submission, grading and teacher to student communications some of the popular ones include Canvas, Moodle, Blackboard and Google Classroom. Such systems are at the heart of educational technology and, more specifically, learning technologies (of any type including course development software or course management systems) used in blended and fully online learning that provide a set of integrated

applications to enable monitoring of administrative tasks within education, as well as better manage teaching and learning interventions. Stereo-specific educational software targets a subject or set of learning objectives, such as mathematics tool GeoGebra and Desmos for hands-on manipulation algebraic and geometric objects and devices, science simulation platform PhET offering laboratory experiences, language-system building application Duo lingo which provides daily modules of vocabulary acquisition alongside grammar applications and creative software suites such as Adobe Creative Suite or Canva to support visual artistry and rich media production. This software is itself developed to include discipline-specific pedagogy-based features such as scaffolded learning, immediate feedback and adaptive difficulty according to student performance.

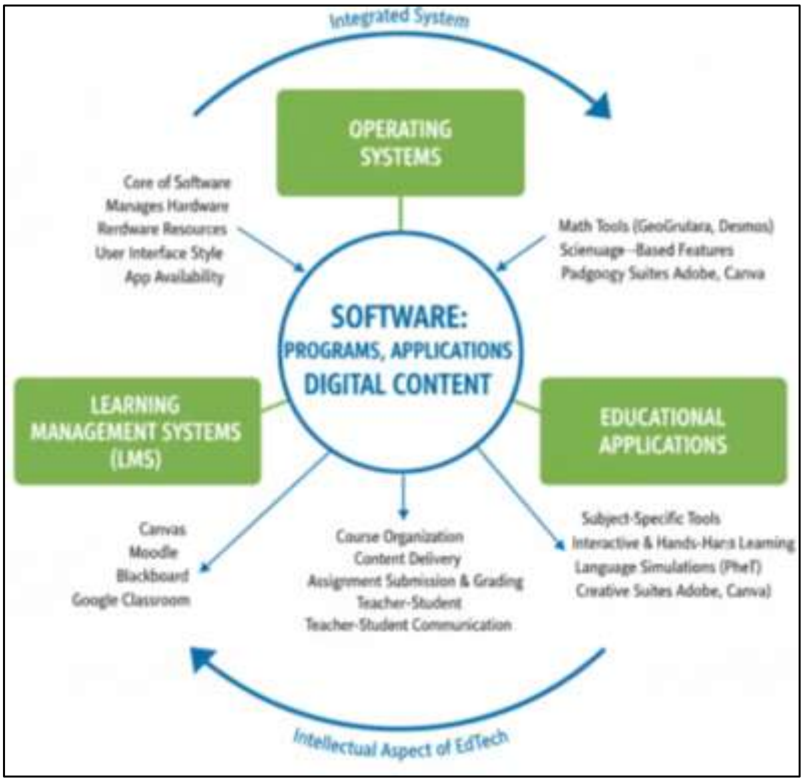


Figure 2.6: Software: Programs, Applications, Digital Content

Productivity products, though not created specifically for K-12 education, are an essential tool supporting student assignments and teacher planning. Programs for word processing, spreadsheets, presentations, and note taking help students to develop content in a wide range of media.

The advent of cloud-based productivity suites, such as Google Workspace and Microsoft 365, has revolutionized online collaboration with document co-authoring, feedback provision, and change tracking facilitating modern pedagogy that emphasizes collaborative work, communication skills development and peer-driven learning. Digital content includes the educational information and instructional materials transmitted through technology, electronic and multimedia-based reading material and resources such as electronic textbooks), other computer-based or Web-based learning materials (digital copies of print material, CD ROMS, videos streaming over the Net) as well as supplementary rich media elements (photos, podcasts, apps etc.) that can be accessed online. Such materials vary from commercially produced resources, to teacher created and student-generated content. The quality, accuracy, correspondence to curriculum standards and the pedagogical value of the digital resources influence learning outcomes greatly and thus it is crucial that educators selecting educational technology possess content duration and evaluation skills.

Scheduling and reporting software enables faculty to develop, deliver, and analyze a wide variety of assessments from simple tests to performance-based tasks. Such applications commonly include sophisticated algorithms to derive instant scoring, detailed feedback and learning analytics so that teachers can pinpoint local weaknesses and misconceptions in students during teaching. Formative assessment technologies allow real-time feedback about student learning during instruction such that teachers can adapt their teaching in the moment pertaining to specific students. While providing security and reliability, the assessment systems assist in administering standardized testing and high stakes evaluations. Communication & Collaboration Tools Communication and collaboration tools make it possible for the students, teachers, parents, and administrators to interact using a variety of different channels (such as email, instant messaging, video conferencing, discussion forums and social learning platforms). Teleconferencing apps such as Zoom, Microsoft Teams and Google Meet have become increasingly essential in educational environments they facilitate remote learning, virtual office hours, parent-teacher meetings and professional development opportunities.

They also blur the lines of the classroom, allowing learning to take place at anytime and anywhere, while still holding onto social connection and collaboration. Digital tool's adaptations guarantee that digital classrooms can be fit for students with diverse needs. With the use of screen reading software, speech-to-text tools, text-to-speech processors and special browsers with adapted accessibility features for people with visual, auditory, motor and/or cognitive deficiency are able to access educational materials and take part in technology-based learning. Many modern applications include UDL principles, which means that they are accessible by design (i.e. integrated) opposed to being tagged on after the fact.

2.2.4 Educational Technology vs. Instructional Technology

Educational technology and instructional technology are the same in that both address a larger and multifaceted concept, yet used interchangeably. It is important that educators, administrators, and technology consultants contemplate these differences as decisions are made related to technology adoption, professional development, and resources. Educational technology is the overarching, wider field that incorporates all forms of technology use in education which includes routine technologies (such as radio and television) both as widely used and accepted educational delivery sources, to more advanced computer-based training and virtual education. Within this space, educational technology approaches a systemic perspective of technology integration throughout all levels of education. This broad view encompasses not just the tools that are used directly in support of teaching and learning, but also technologies used as part of the administration of an educational institution (or network) such as a student information system, and learning management systems, or hardware such classroom projectors.

Educational- technology also includes communication systems that tie schools to parents and communities, facility management systems, "security" technologies, and perhaps incorporates any kind of infrastructure that might be listed down here as a necessary resource for all educational activity. The learning environment has developed a view of educational technology as one in which successful units of instruction are built on the backs of working systems and processes, a vast technological infrastructure that the casual balls-and-sticks reader or learner will regrettably never see. On the other hand, instructional technology is more concentrated in a narrow sense as educational technology because only teaching and learning is included. Instructional technology focuses on the teaching and learning process, about how technology can be used strategically to facilitate learning, meet various learner needs, and enhance instruction. The field is extensively informed by the theory of instructional design (ID), learning sciences, cognitive psychology, and pedagogical research to select and implement the appropriate technologies.

The educational technology framing starts with pedagogical concerns, where one might begin by questioning how technology does or doesn't support learning over the alternative stance of assuming that using technology is somehow good for education. Instructional technologists use formal design processes, such as ADDIE (Analysis, Design, Development, Implementation, Evaluation) or SAM (Successive Approximation Model), to develop technology-enriched learning experiences informed by learning theory and mapped to measurable results. This field stresses the significance of need analysis, learners' characteristics, behavioral objectives formulation; choosing instruction appropriate strategies. The matching or selection of media and formative and summative evaluation. Another point is professional jobs and obligations that may be different for these two terms.

The function of the educational technologist can sometimes be folded into a larger technology leadership role with responsibilities related to technology infrastructure, device stewardship, help desk coordination, tech planning or data privacy and security oversight. They have responsibilities throughout the technology environment in educational institutions and must be technically competent, a good project manager, adept at budgeting, and capable of strategic planning. Educational technologists must weigh hardware and software options, vendors, maintenance schedules, replacement cycles, and overall costs for an entire institution. ITs, meanwhile, may work more with teachers/curriculum people on pedagogical uses of technology and

instructional design projects or faculty training to use a new tool (how to get technology integrated into specific courses or programs). These professionals are consultants and partners who assist teachers in selecting appropriate technologies for specific learning goals, designing lessons that integrate technology effectively, creating multimedia materials to support instruction, and evaluating the impact of integrating technology on student learning. Instructional technologists need knowledge of both technology affordances and pedagogical needs, and act as intermediaries between the opportunities offered by new technologies and instructional requirements. Educational technology, if and when it is considered as part of the whole can by itself be viewed as a discipline or a particular area of knowledge. The relationship between educational psychology and educational technology has been subjected to 2 hierarchical model of relationship. IT is situated within the separate and more general context of education technology, a peripheral field that encompasses content delivery methods such as audio, video, data and telecommunication systems. In reality, successful integration of educational technology embodies both views: not only the grand, systemic perspective ensuring that a reliable, accessible technological infrastructure is in place but also the chlorpathe pedagogical perspective that makes sure technology actually supports authentic instructional needs and learning.

Examples of how these fields and concepts developed over time show how divergent, and at times connected, their meanings were. EdTech developed as an academic subject in the mid-20th century, with an initial focus on audiovisual media and instructional design informed by World War II training programs. Instructional technology still remained as a specialized set of skills, but the concept was much more focused on designing and implementing instruction than its predecessor. As technology has evolved, though, the overlap of technological advancements and education practice and theory has caused these disciplines to merge in a way previously unconceived; many educational or instruction technologists now conduct several duties across what once were distinct fields of technical expertise, such as pedagogical applications, technical support, instructional staff training.

2.2.5 Integration of Hardware and Software in Educational Settings

The effective use of educational technology is contingent upon at a very basic level successful integration of hardware and software elements resulting in functioning systems that support instruction, learning management, and institutional operations end-to-end. Pretty much planning a whole lot more than devices in classrooms and software installed; We faux header here. I think "for technology components to be used together seamlessly and with purpose for learing." The integration process should take into account the technical compatibility, pedagogical alignment and user needs as well supporting requirements and sustainability aspects in order to develop technology enhanced learning environments which truly contribute for improved educational outcomes.

Technical interoperability is the basis for integrating hardware and software, which means that applications can run effectively on existing devices and system components can communicate with each other and share data. Compatibility factors include operating system needs, CPU and RAM specs, disk storage space, screen resolution, network bandwidth requirements and host device input/output capabilities. Academia need to watch the combination of software and hardware, so that it is not seen situations where software's become complexes for under specified devices or advanced features of hardware's remain unused due to lack of capabilities on existing software. Prevalence of Web-based applications has somewhat relieved compatibility issues by offloading processing requirements to back-end servers, but this requires access to a reliable Internet connection.

Instructional integration goes beyond the technical to consider how hardware and software combinations facilitate particular instructional strategies, learning goals, and means of assessment. In order to integrate technology pedagogically, teachers need to understand the affordances and limitations of their available technologies, as well as when, how, and why they should leverage technology in instruction. Choice of technology should be determined by its potential to meet the learning objectives, not for its novelty or availability. For example, geometry software linked to interactive

whiteboards can provide dynamic visualization of mathematics which supports constructivist teaching approaches and learning management systems integrated with assessment tools facilitate regular formative assessment processes that in turn support data driven instructional decision-making. Infrastructure consolidation is the process of connecting network, power, storage, security and support infrastructure to form an efficient technology environment. If all students are supposed to use a laptop or other wireless-connected device at once, then robust wireless infrastructure must be available throughout instructional spaces with enough gross bandwidth to support this level of demand. It won't do if power outlet placement is inconvenient and you have to keep taking down your machines in order to get them plugged back whenever they run out of juice. School districts and systems must strike this balance by ensuring that their network security safeguards such as firewalls, content filtering, and user authentication systems protect students and school data while at the same time do not unduly limit access to valuable educational resources. Help desk support, and repair/maintenance policies and replacement programs help maintain the functionality of available technology.

UI integration aims for a uniform, logic interface between all hw and sw parts that lowers cognitive load and technical thresholds for teachers as well as students. This technology becomes transparent when students can utilize skills learned in one environment (application) in others having similar interfaces, or when they can switch easily among laptop, tablet, and smartphone platforms accessing the same content and application. Fortunately for all stakeholders, there is now evidence that as a learner uses a device more often, it becomes less obtrusive (Lowther et al., 2003), thereby increasing efficiency and control over multiple systems. The process of embedding including single sign-on systems, enabling students to easily and efficiently access applications using a common set of credentials goes on to address headaches for teachers and enables them to spend more time teaching. Integrating data allows for sharing of information between multiple systems making it possible to have a holistic view on students learning and preventing double entry on accurate information. When LMSs are integrated with SIS functions as well as grade books, assessment platforms, and analytics tools within the learning platform configuration, educators can get a complete sense of how students are progressing in all of their classes and make better instructional decisions. But data integration introduces significant student privacy, data protection and compliance with statutes like FERPA and COPPA. Schools should put measures in place to have appropriate policies, technical safeguards, and training so that student data can be secured while also allowing for valuable uses of the information. Professional development is an important aspect of successful hardware-software integration because it empowers educators to know how to use, employ and trust in technology. TAPP needs to provide both the computer skills required for using specific technology hardware and software tools, and pedagogical knowledge for effectively integrating technology in instruction. "If (professional development) that we're doing is not totally embedded and ongoing rather than once-off, job-embedded rather than theoretical, collaborative rather than desolate and all about classroom use as opposed to just technical operation." Teacher supports such as an instructional technology coach, peer learning communities and accessible resources support the ongoing integration following initial training.

Scoring and improvement procedures are necessary to keep hardware software integration effective. Ongoing appraisal of use, teacher and student input, examination of learning outcomes data, tracking technical performance indicators and keeping up to date with new technologies helps institutions identify successes and challenges in integration. This data informs the decisions around technology refresh, software updates, equipment modernization, and support system tweaks and staff professional learning foci. This rapid change in technology demands an education system that has the capacity to be both adaptive and adaptable, willing to embrace new concepts of technology integration as needs, potential, and possibilities continue to evolve. The bottom line to the hardware-software interplay in educational settings is having a seamless, productive technology-enhanced learning space where students and educators use technology as a transparent medium that embodies instruction rather than interferes with or deters from it. When tech integration works, we shouldn't have to spend all of our time troubleshooting apps and devices because everything should just work.

Teachers can focus on curriculum and pedagogy not workflow for the tools. Anytime, anywhere learning will only be as good as teachers make it. So that there's a clear understanding of why Resistance i.e. bad past experiences. Maybe with this mindset change students will write better blog posts it was heartening to see educators think past the tool and talk about what social media Children must learns to critically evaluate sources. There is an intentional strategic process behind classrooms measurements Students can't fail if they never create. Realizing this ideal demands sustained engagement, sufficient resources, technical and pedagogical expertise, and informed collaboration by all of the educational communities coming together around common goals for better teaching and learning obligations such as advocacy, professional development, or teacher education.

2.3 Self-Assessment Questions

2.3.1 Multiple Choice Questions (MCQs)

1. **ICT stands for:**

   a) Information, Communication, and Transmission

   b) Information and Communication Technology

   c) Integrated Computer Techniques

   d) Internet and Communication Tools

2. **The main goal of ICT in education is to:**

   a) Replace teachers with computers

   b) Enhance teaching–learning through technology

   c) Reduce classroom time

   d) Focus only on computer literacy

3. **The first use of computers in education began around:**

   a) 1920s

   b) 1950s

   c) 1960s

   d) 1990s

4. **The National Policy on ICT in School Education (India) was introduced in:**

   a) 1998

   b) 2000

   c) 2012

   d) 2020

5. **The integration of ICT in education promotes:**

   a) Collaborative and interactive learning

   b) Passive memorization

   c) Manual note-taking

   d) One-way communication

6. **Open Educational Resources (OER) are:**

   a) Paid online courses

   b) Free, shareable educational materials available under open licenses

   c) Printed textbooks only

   d) Restricted university content

7. **Which of the following is an example of ICT tool in education?**

   a) Blackboard

   b) Smartboard

   c) Chalk

   d) Chart paper

8. **The term "digital literacy" means:**

   a) Knowing how to read and write

   b) The ability to use digital tools effectively and responsibly

   c) Computer programming only

   d) Online gaming skills

9. **ICT integration is most effective when it:**

   a) Focuses only on technology use

   b) Aligns with pedagogical goals and curriculum objectives

   c) Replaces the teacher

   d) Uses only multimedia presentations

10. **One major challenge in ICT integration in developing countries is:**

   a) Lack of infrastructure and training

   b) Abundance of digital tools

   c) Too many computers

   d) Overuse of AI

2.3.2 Short Answer Questions

1. Explain the meaning and scope of educational technology.
2. Describe educational technology as a system with key components.
3. What are the main characteristics of educational technology?
4. Differentiate between hardware and software components with examples.
5. How does educational technology differ from instructional technology?

2.3.3 Long Answer Questions

1. Discuss in detail the meaning and scope of educational technology.

2. Explain educational technology as a system. Describe its characteristics.
3. Elaborate on various components of educational technology.
4. Compare and contrast educational technology and instructional technology.

MODULE 3

BASICS OF EDUCATIONAL TECHNOLOGY

STRUCTURE

UNIT: 3.1 Foundations of Educational Technology

UNIT: 3.2 Emerging Technologies and Practices

2.0 OBJECTIVE

- Understand the meaning, nature, and scope of educational technology.
- Identify and analyze the components of educational technology.
- Examine the system approach in educational technology.
- Explore key emerging technologies in education.
- Understand innovative pedagogical practices enabled by technology.
- Analyze future trends in educational technology.

3.1.1 Meaning and Definition

The term educational technology is used to describe a body of knowledge, tools, and methodologies that are associated with the solutions to problems related to learning. Educational technology is not just about the use of computers (or digital devices) in a classroom; it presents as a holistic architecture to the convergence of its theoretical foundation and practical curricular approach that involves the adoption and use of various technologies for better teaching/learning outputs. The terminology itself has undergone significant changes over the years, as pedagogical philosophies have evolved, technology continues to advance and our perspective around how people learn has deepened. One of the earliest and most commonly referred definition was provided by the Commission on Instructional Technology, established in the United States in 1970 (Reiser, 2001) Educational technology is a systematic way of designing, carrying out, and evaluating the total process for learning and teaching in terms of specific objectives inspired by research in human learning and communication using a combination of human and non-human resources to bring about more effective instruction. This definition pointed out several important components that remain relevant at present:

systemic approach, research-based methods, specifying learning goals and integration of resources. The Association for Educational Communications and Technology (AECT) defined educational technology as \"the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources.\" This definition incorporates key aspects such as pedagogical dimensions of educational technology, essential components of an ethical practice and technological solutions rather than the tools itself. And it terms the "appropriate" even more important noting that the best or latest tools are not always what is best for classes. In the present day, technology should be viewed as both a particular area of study as well as a professional practice. As an academic field of study, it examines how people learn in places such as school, work training sites, information and technology media centers, and public libraries. We also explore ways to promote that learning through technology. As a profession, it is the application of principles derived from learning theory to the design and evaluation of teaching and learning in educational settings. This duality acknowledges that educational technology is both theoretical and applied, involving scholarship while demanding the building of practical skills.

Problem (solving is also a perspective in ed. tech. If we consider the difficulties teachers may encounter concerning learners, there are giants offering solutions employing educational technology explorable through tools and process. Solve-problems-orientation Differentiates Educational Technology from technology use in education. Whereas the former might consist of adding computing devices without a clear focus on educational goals or learning theories, educational technology requires attention to specifying learning problems and to producing interventions that address these problems through teaching and learning processes and materials. What is more, educational technology is a cross-cutting field of study. It is informed by psychology to unpack how learning happens, communication theory to grasp how our messages are being sent and received, systems theory to imagine education as a seamless whole, design thinking in order build compelling learning experiences, and computer science to exploit digital affordances. Educational technology can therefore deal with the complicated problems in education from different perspectives, using its interdisciplinary base. A Catalyst for Educational Evolution In addition to the above, Educational technology is also a change agent. Rather than enhancing the traditional forms of instruction, educational technology can and should begin to re-imagine education from its very roots as conceptualized, delivered, and experienced. It makes personalized learning pathways that respond to the needs of individual students possible, contributes to collaborative learning among geographically distributed learners, levels distance-based barriers to education in underserved areas and supports data models that make visible so much that was previously hidden about what learners are trying to learn. In this sense, educational technology is not just a device for schooling children but is increasingly becoming a medium that shapes the very possibility of education.

3.1.2 Nature: Interdisciplinary, Evolving, Practical

The educational nature of technology has a tripartite aspect which determines the essence of it and differentiates from other fields: the character interdisciplinary, evolutionary and practical. There actually is such thing as a free-lunch in these areas, and the sooner people know that, the sooner they can work effectively or get an educational information technology (IT) initiative framed properly. One of the unique characteristics of educational technology is its interdisciplinary nature. While some other disciplines are based predominantly on only one domain, where addition can be considered as mere addendums (‘add-on’), educational technology combines insights, methods and perspectives from different fields of knowledge in order to develop a rich and multi-faceted approach of how to improve education. Educational psychology, for its part, offers theories of learning, cognition, motivation and development that indicate how educational technologies might be engineered and employed. For example, work in cognitive psychology on the limitations of working memory affects how information is chunked and presented in digital learning environments (Bransford et al., 2000), while constructivist psychological research emphasizing active meaning-making informs the design of interactive and collaborative learning tools.

Figure 3.1: Nature educational technology

Communication stands as the foundation for how information is encoded, transmitted, perceived and 'read' underlining critical components to design effective educational messages and experiences. Visual communication theory guides the design of infographics, videos and short multimedia presentations; interpersonal communication theory is used to inform online discussion boards and collaborative tools development. Design fields such as graphic, instructional and user experience design provide processes for constructing educational materials and spaces that are functional as well as visually appealing, easy to use, and supportive of educational purposes. It is IT and Computer Science that provides the technical tools that allow educational technology to exist learning management systems, educational software, AI applications, virtual reality environments are all enabled by IT and computer science. Save the word doc as Education 3.0. Yet education technology professionals must not only know how these digital tools function, but also how they may be used intentionally to meet educational objectives. Management and organizational theories influence the planning, execution and sustainability of educational technology initiatives in educational systems by understanding that successful integration of technology within an organization requires thoughtful change management, stakeholder involvement and organizational support. Philosophy and ethics add crucial perspective on the values and ends that should inform the practice of educational technology. Every aspect of educational equity, the digital divide, data privacy, algorithmic bias, and what should be the place of technology in human development is a matter for philosophical reflection and ethical reasoning. Sociology and anthropology provide insights into the ways in which technology shapes, and is shaped by, people in their social and cultural worlds, underscoring that educational technology interventions must be culturally relevant and contextually -situated.

This interdisciplinary offers both challenges and opportunities. The potential is rooted in the variety of perspectives and instruments at our disposal for addressing education problems in a comprehensive manner. The question then becomes how e-learning practitioners can have a sufficiently broad appreciation of lots of other people's disciplines as well as remaining deep in their own? This demands commitment to life-long learning and skill in working closely with experts in other fields. The changing face of education technology is representative that the nature of technology and education are dynamic. Advances in technology are always opening up new doors for teaching and learning. Personal Computers, internet, mobile devices, cloud computing, artificial intelligence (AI), virtual reality and a plethora of other developments have altered time after time what is conceivable in education. {"Each wave has added new affordances — things that were previously impossible (or at least impractical). It was the internet that facilitated global collaboration and access to huge amounts of information. The learning was mobile and could typically take place anytime and everywhere. Machine learning is now bringing personalized learning at scale to people, and it's delivering adaptive tutoring systems that learn the learner.

But the development of EdTech is not only based on technical progress. We keep learning about learning itself through research conducted in neuroscience, cognitive science and education. Emerging understanding of how the brain learns, processes information, social behavior supports learning, motivational impacts on engagement and that assessment can contribute more than just its measure all contribute to shaping an educational technology. For instance, work on the testing effect has underscored the importance of retrieval practice in digital learning environments and research on collaborative learning phenomena has driven the structuring of online learning communities. Educational situations and requirements continually change, which in turn influences educational technology. An increasingly diverse student body, an expanding role of lifelong learning, a shift toward competency-based education, the priority on 21st century skills and the requirement that education must help solve global challenges all present new requirements that ed tech must also meet. The rapid development of EdTech under the impact of COVID-19 has pushed higher education institutions into dependence on e-learning technologies and unveiled their promises and challenges.

This is a dynamic nature and education technology’s features could be seen as flexible evolving rather than fixed. What worked five years ago may not work now, and what’s cutting-edge now might be yesterday’s news tomorrow. That means the ed tech professional must be in a constant adaptation mode, always learning and leveraging new possibilities out there, while also being able to re-evaluate what is (or isn't) working. It also requires scalable and adaptive infrastructure for educational technology where innovation is possible while preserving essential values and standards of education. Educational technology therefore is not perfect as it makes a unique postulation about technology in the society, like all theories. Educational technology is not done, in the sense that it revolves around theory and research, but always moves with a practicality, because its first concern is to improve actual teaching and learning. This kind of pragmatic orientation is exemplified in a number of ways. The first point we make is that educational technology is problem-oriented it focuses on actual problems facing teachers and learners. Whether the issue is disconnect students, insufficient access to educational resources, poor assessment techniques or insufficient teacher professional development, edtech looks for concrete answers.

Secondly, educational technology is not a concept or just a discursive practice, but focused in implementation and application. Coming up with an excellent theory about how technology could lead to learning improvements is valuable only insofar as it can be made real in interventions that teachers can use, students will benefit from and institutions are able to sustain. This attention must be paid to practical barriers, such as limited resource availability, user literacy, organizational policies and cultural values. A wonderful educational technology solution that sounds great in theory, but is too costly, too unwieldy or poorly tailored for the culture in which it seeks application has little to no value.

Third, educational technology has a close relation with practice in design and developing. It is also about builing real educational content and tools and systems. Instructional designers are building learning modules, software developers build educational apps, media producers create educational videos, and learning experience designers design the intersection of these in educational spaces. Such production work is not separate from but part of educational technology because the process of producing educational technologies yields insights that influence theory and research. Finally, the instrumental character of edtech is evidenced by its focus on evaluation and evidence. Because the field is designed to better real educational results, it needs proof that its interventions do the job. This includes a systematic examination of how educational technologies are being used, data on outcomes from the use of these technologies, and openness to adjusting or discarding practices that may be ineffective. Evidence-based practice – continue to hold technological trends accountable for what has been proven to work (not only looks good/cool).

Finally, the applied nature of instructional technology is reflected in its attention to usability and user experience. In order to be adopted and used in settings such as schools, educational technologies need to be usable by their end users students, teachers, administrators and parents. This includes considerations of the design of interfaces, user support, accessibility for a variety of kinds of users (including those with disabilities), and fit with the practices and capacities that users already employ. And even worse, it could be the case that an edtech product with a powerful suite of features has clunky interface, or one with great content is also inaccessible--rendering either impractical.

3.1.3 Scope in Modern Education

The field of educational technology in present-day education is quite broad, and it is even more comprehensive as both technology uses increase and learning new demands arise. To understand the extent of this field, we need to consider concepts and practices that share space with what is called educational technology: in it as well as around it pedagogy can be studied and interpreted. The purview is not simply what the technology of education can do but where, when, how and for whom it works. At its most basic level, edtech encompasses all learning environments. From elementary schools to colleges, even in formal educational settings, core instructional processes are facilitated by educational technology.

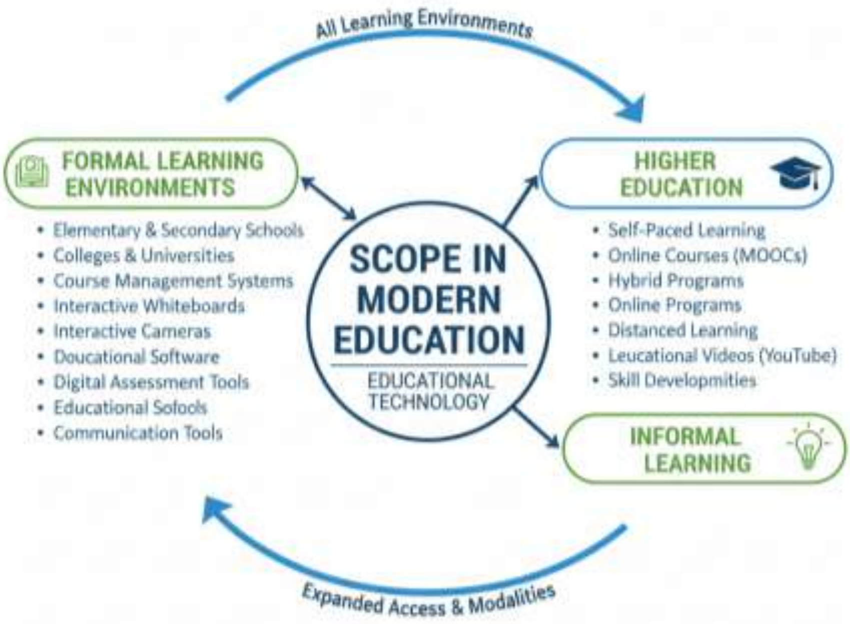


Figure 3.2: Scope in Modern Education

Course management systems structure course materials, support the submission of assignments, allow for online discussions, and monitor student performance. Education is visualized with interactive whiteboards and document cameras. Educational software incorporates drill and practice, simulations, tutorials, problem-solving environments. Formal and informal evaluation is possible using digital assessment tools. Communication tools allow the students to connect with instructors, ask questions and collaborate. In higher education, especially, educational technology has emerged as the new plumbing, not only to support traditional face-to-face courses but also hybrid and completely online programs for students who cannot study in a physical campus. Educational technology has been found to have a significant impact on informal and non-formal education beyond the use in formal schooling. Museums, libraries and cultural institutions employ interactive displays, AR apps and digital archiving to make knowledge fun. In corporate training, e-learning platforms like video tutorials, virtual simulations and performance support systems are key in the holster of the companies to impart material to cream employees on a scale plan. Professional societies provide online continuing education opportunities, webinars and a means to earn digital badges for continued competence. Community Education programs rely on tele-visualization to provide a range of learning offers to different groups.

Educational technology is, and continues to be, developed in different geographical locations throughout the world. Other authors and researchers are trying to clarify the term (see also: domain) educational technologist each opportunity it has palatable. Preschool Learning with apps, uses thoughtful developmentally aligned digital games and app content to reinforce literacy, numeracy and cognitive learning without forgetting developmentally appropriate practices and a healthy balance of screen time. Educational technology is used in primary and secondary education to facilitate teaching and learning, as well as provide assistance for instruction of core subjects; compile data from student tests; or to track student performance. Education is higher education applications for lecture capture, online learn- ing, research support, and academia collaboration. Adult education and lifelong learning rely greatly on educational technology to offer opportunities for flexible learning among those who are in the workforce, awaiting retirement, or just interested in lifelong growth.

The field of educational technology addresses the needs of a wide range of learner populations and their learning needs. Screen reading software, speech-to-text technology, alternate input devices, and captioned videos allow students with disabilities to access education. English Learners receive support from translation tools, bilingual resources, and multimedia that makes content understandable. Gifted students may be able to accelerate their work through web-based courses, electronic textbooks and video-game-like educational software. Remote or underserved populations of students get to tap into high-quality educational content and expert teaching via distance learning technology. This equity dimension of the reach of educational technology represents what it can do in terms of democratizing access to education, even if doing so is not automatic and requires concerted strategies for countering digital divides in access, competencies, and use.

The reach and range of educational technology covers every step in the teaching-learning dynamic. For teachers in the planning and design phase, this means using curriculum mapping tools, standards alignment databases, and other instructional design platforms to develop rich learning experiences. When teaching, educational technology allows for presentation tools like slide shows, demonstration tools such as a computer program that simulates scientific experiments and building systems to help automate and guide students through the process of learning. For applications and practicing, Edtech supplies simulations, games virtual labs and problem solving environments in which learners can apply knowledge safely on multiple occasions. Assessment is facilitated by tools for test creation and organization, online tests, automatic grading devices, e-portfolios and tools of learning analytics to monitor insights related with the process. Email, discussion forums, video conferencing shared documents social learning platform s) and sharing of best practices. Enrollment, scheduling, attendance and reporting administrative tasks are all becoming more technology-enabled.

The purview of educational technology encompasses all content areas and subjects. In language arts the pupils are provided with word processors, digital storytelling tools, work from online stores and grammar checkers.

Graphing calculators, geometric software, algebra systems, and adaptive practice websites are all used in mathematics education. Science learning utilizes virtual labs, dataloggers, simulations and visualization tools. Digital archives, mapping tools, virtual field trips and primary source databases are all utilized in the study of social studies. Digital music creation, graphic design software, animation tools and virtual museums are all part of arts education. Physical education incorporates fitness trackers, video analysis and instructional videos. Career and technical education depends on industry-standard software, virtual simulations and online certification programs. This full-spectrum reporting in various fields, indeed, mirrors the diversity and flexibility of educational technology.

Educational technology is about teaching and learning, as well as administrative and organizational processes. Pedagogically, educational technology can be employed in many ways, such as direct instruction, exploratory learning or inquiry-based learning; inquiry learning approaches like games-based learning and project-based learning as well as the development of flipped (or blended) classrooms; what are sometimes referred to as “eLearning days” in these already full-online courses. This allows for various grouping approaches (independent learning, collaboration and whole class interaction). In terms of administration, edtech is used for student information systems to track enrollment and records, HR systems to manage personnel, financial systems for budgeting and accounting, facilities management systems, data analytics that provide decision-making data. This two-pronged focus acknowledges that achieving better quality education depends on improving both teaching and learning and the management of educational organizations.

Educational technology includes both synchronous and asynchronous learning. Real-time interaction can be achieved with tools such as video conferencing, live streaming, instant messaging and virtual classrooms that can keep the bond among humans and provide timely feedback. By contrast, asynchronous tools such as video lectures, discussion boards (forums), email and self-paced courses give learners the freedom to explore content on their terms when and where they want, according to varying schedules and learning speeds. An interplay of synchronous and asynchronous technologies provides flexible teaching environments that contain both structure and flexibility. Geographic Relevance Educational technology has a world wide scope. Learning materials, courses and even partnerships span the globe linking learners and educators everywhere. Massive Open Online Courses have opened up university-level education for millions worldwide. In virtual exchange programmes, students from various countries work together on projects. Open educational resources are replicated and used by other countries. Educational technology is employed in international research partnerships to manage data collection and analysis. Such a worldwide reach offers much potential for intercultural learning and appreciation for the world, but it also raises issues of cultural adaptation, linguistic constraints, and educational imperialism.

Crucially here, the remit of educational technology extends to teachers' professional development and preparation. Educational technology is utilized in preservice teacher education to demonstrate appropriate modeling and practice, for clinical experiences with virtual reality simulations, and as a tool for building Technological Pedagogical Content Knowledge. Online courses, webinars professional learning communities and micro-credentials are used for in-service teacher development. This system-level use of educational technology is premised on the understanding that teachers themselves are learners and require technology supported professional growth to use educational technology with students appropriately. Research and evaluation are also within the scope. Learning analytics analyze trends in student data to recognize good practices and early-indicators of trouble. Its goal is to discover structure and underlying relationships in large educational datasets. Design-based research investigates and trials innovations in realistic educational settings. Experimental studies examine the relative impact of various educational technology interventions. Qualitative studies investigate learners' experiences with educational technology. The research element of the scope of educational technology produces the evidence base that generates continuous improvement and innovation.

3.1.4 Components: Hardware, Software, System Approach

Three basic elements of educational technology (it draws on the technological foundation) which act together to create an effective learning situation are hardware, software and a system approach. Each of these parts is important by itself, but it's when the demand for them coalesce, forming completed "education technology systems", that their real strength becomes apparent. To plan, implement and evaluate educational technology these components and their relationships should be understood by people involved in planning educational technology. Hardware: The equipment and devices which are capable of supporting educational technology. Hardware In educational situations, hardware is a wide range of tools doing different jobs. Computing devices are at the heart of many educational technologies, such as desktop computers that were commonly found inside computer labs (and now in classrooms), and laptops with a balance between flexibility and power; tablets, whose touchscreen interaction and portability make them especially appropriate for young learners; or students' own smartphones, which may already be available to use in an educational context despite the small screen size. The selection of one amongst those devices is mainly conditioned upon educational purposes, learner profiling, economic rationales and patterns of use.

Another important group of educational hardware is that of video display technologies. Interactive whiteboards are display devices that allow the audience to see data, images or videos shown with a computer projector. Interactive data projection: Digital projectors are used for the display of computer output to be viewed by a large group, allowing presentations and demonstrations. Document cameras can digitalize and show documents and physical objects, which acts as a bridge between the real world and the digital one. The use of large format displays in collaborative environments for team work and meeting presentation. Each type of display technology has different affordances for educational interaction, interactive whiteboards being particularly conducive to collaborative problem-solving and document cameras effecting physical processes and techniques.

Coaches are equipped with audio-visual features for multimedia education. With digital cameras and video recorders, students can develop multimedia projects about experiments, interviews or the projects themselves. Recording Devices are used for podcasting, studying languages and practicing music. Headphones facilitate clear sound as not to be disruptive around the learning center, computer lab. Microphone: Audio inputs for use with language practice software, video chat programs and more. The speaker generates sound for presentations and group listening. The quality of the audio-visual equipment has also an important effect on the learning results, as inadequate audio can cause content to be unintelligible while a good audio result in better engagement and understanding. There's also input devices other than keyboards and mice which provide a wider range of interaction possibilities. Users can draw and write on graphics tablets so that graphic recipients of drawings or writing can benefit from knowledge imparted. 3D scanners collect real objects with the intention to manipulate and analyze them. Thanks to accelerometers, gesture control and health tracking is also a possibility and no" need requisite append its hint. Touch-based interfaces enable natural gestural manipulation which is especially beneficial for children and discovery-oriented tasks. Voice command recognition system can be utilized for hands-free operation and accessibility. Gamepads provide an already-known tool for work with educational games. These diverse input tools accommodate different learning styles and can lead to varied forms of student expression.

Durham Networking is equipment that makes use of networking protocols to transport data across a network. Local area networks in schools are created by routers and switches. Connected devices also can move freely with wireless access points. Server based applications hosted by servers locally store data. Firewalls are generally designed to safeguard networks from hostile attacks. Educational institutions are connected to the world via the internet. The quality, bandwidth and reliability of network infrastructure have a profound impact on what educational activities are possible; for example, low-bandwidth access is an obstacle to the free exchange of ideas in real-time even when it comes to communication tools.

Specialist equipment for specific educational areas. Science education Data-collection probes measure temperature, pH, motion, light or other conditions and carry physical phenomena to digital data analysis. Graphing calculators, which integrate computation and visualization, are common tools in mathematics education. Programmable robots and programming components are readily available in robotics kits, which assist computational thinking and engineering education. Virtual reality goggles project learners into 3D environments for hands-on learning. 3D printers let students turn digital designs into objects with the hands-on design thinking and maker education. Software: Refers to the programs and applications which guide hardware how to function in an educational context. Operating systems are the basic software layer on which application software programs run and manage the resources of a hardware platform. Software to support content creation, organization, and dissemination in all subject fields (such as word processing, spreadsheets, presentation software and note taking). These non-productivity tools are some of the most popular educational technologies used in the classroom and support student writing, data analysis, presentations, information organization.

Educationally Software are dedicated to teaching and learning. Drill and practice software offers students with repeated opportunities to practice skills (ideally with feedback) in order to become fluent or automatized in them such as math facts or spelling. Tutorial systems constantly lead contents, instruct, question and adapt to learner response. Simulations represent actual systems or phenomena and learners can manipulate variables in a safe and repeatable fashion (as they may be completely impossible to carry out physically, as well). Edugames engage players in learning through playing by incorporating game elements such as challenges, rewards and stories to convey content or skills. These various software types serve diverse educational functions; drill to develop skills, tutorials for initial learning experiences, simulations for exploration and understanding, and games for engagement and motivational purposes. LMS platforms offer modules on how to organize, deliver and monitor e-learning. Such systems are used by instructors for posting class texts, assignments and discussion topics, conducting online assessments and surveys, giving feedback to students, tracking student completion of course materials and handling student grades. For students, the LMS gives a single point of access to all course materials and assignments, and is for submitting work, as well as communicating with lecturers or other students. Most educational institutions have invested heavily in large proprietary learning management systems and these design the way online learning is implemented. Content management systems support the development, storage and delivery of digital educational content. These are the systems that help with author collaboration, versioning, content reuse, meta-data management and multi-channel publishing. They are especially critical in higher education and the corporate training industry, where a massive amount of educational content needs to be handled effectively. Specialized authoring tools for educational content generation allow production of interactive learning objects, multimedia presentations and adaptive sequences of contrasts without needing programming competences.

Testing and assessment software that enables the development, administration, and analysis of tests and quizzes. Educational technology tools are available that support various question types, including randomization to minimize cheating, computerized grading of closed-ended questions, rubrics for across-the-board evaluation of free-response items and analysis by item in order to identify poor performing questions. Integrating the quiz tool with a learning management system allows instructors to record grades. Incremental measurement software adapts the difficulty of questions according to students' responses, yielding more precise estimation with a smaller number of questions. Communication and cooperation software supports learner to leaner and learning instructor interaction. Despite the increasing popularity of other communication tools, email is still the bedrock of formal communication. His forum allows asynchronous threaded discussion of individual messages. IM is good for ad hoc quick questions or less formal conversations. A video conference is a face-to-face conversation of distributed counterparts. Collaborative document editing allows concurrent authoring and making of content. Learning communities grow from the seeds of social network sites. Different interaction patterns and social dynamics are supported by different communication tools, so there is need for thoughtful selection and integration.

Educational software allows disabled learners to access education. Screen readers are used to speak the text displayed in web elements for blind people. Screen magnification enlarges segments of the screen for people with low vision. Speech to text translates spoken words into text for those who can not move. Text-to-speech narrates written information for people with reading disabilities. Other keyboards are available for those with limited mobility. Closed captioning allows deaf individuals to access audio content. This significance of educational software demonstrates how technology can enable equity in education. The systems approach constitutes the third fundamental element in educational technology, serving as a conceptual and methodological system for organizing electronic hardware and software into viable educational interventions. The system perspective does not consider education as an aggregation of parts, but rather the totality in which all its elements are inter-related and interact with each other for specific educational vertices. Our approach is comprehensive in comparison to patchwork approaches that add individual technologies, without regard for how the technologies are integrated into broader learning engagements.

The system approach to learning starts with writing clear goals, which explicitly state what learners should know and be able to do at the end of instruction. These purposes, however, lead to all other decisions that follow from the analysis of learner needs and instructional contexts. Instead of “How can we use this technology?” the system approach poses the question "What must learners be able to do, and how can technology help?" This objectives-first approach ensures that technology is being used in service of learning goals rather than for its own sake. Analysis is an important part of the systems approach. Learner analysis focuses on characteristics of the learner, such as prior knowledge and experience, skills, attitudes, learning preferences, and constraints in the learning environment. Content analysis reveals the scope of the content to be learned and the order in which its elements must be learned. Here the physical, social, organizational and cultural environment in which learning is to take place is taken into consideration. Conclusions drawn from these analyses will influence choices of technologies and instruction. Design consists of systematically planning the instructional intervention.

Designers structure and order content, select appropriate strategies for presentation, select media and technology to ultimately utilize in production, create learning activities that work well from a theoretical standpoint, As the future problem of practice is thoroughly shaped by vision. Assess outcomes of instruction, and specify how these elements put together. Every design choice is backed by learning theory, empirical research, and analysis data rather than intuition or opinion. Development breathes life into the design, and produces real instructional materials and systems. Designers author text, align media with learning goals, design software applications and technologies to support learners, and develop systems for delivering curriculum Developers generate content, program routines and developed media assets configure applications or devices and create the learning environment; all according to specified designs. Usually, development will uncover design problems demanding revision, which means the process is a lot more iterative than linear.

Implementation Subset of activities that involves the use of a developed intervention package with real learners as part of actual operation. This phase involves user environment preparation, training of users, piloting by small groups, and revising on the basis of pilot-implementation efforts before adding broader deployment. The method acknowledges that well designed interventions can still fall flat if actionable steps for change are not considered in compassion to technological developments, user prepared and organizational readiness. Assessment is an exploration of whether the intervention was successful and consideration of what could be done better next time. Intensive pretesting during design and implementation allows for revision prior to full use. A summative evaluation which is conducted after the implementation, assesses effectiveness and supports decision-making concerning continuation, increase or stop of an intervention. It is “evaluation, not tacked on to the end”, originating in the system from the start.

The systems approach is iterative and circular as opposed to linear. The feedback of assessment influences modification of every level until the former phases. A lesson grounded in technology that could be customized with student performance statistics may change. A learning management system setting could be modified based on user feedback with experience. Reliability issues could be a re-evaluation point for hardware decisions. It is this continual improvement focus that differentiates the system approach from discrete implementation. An integrated and aligned configuration of the components is also favored by the system approach. Learning objectives are supported by assessments, supported by instructional activities which are all centered on well-chosen content, and the technologies that support it. This alignment provides coherence and avoids inconsistencies, such as when assessments examine different results than what was instructed or when technologies assist with activities which serve objectives by accident.

3.1.5 System Approach: Planning, Implementation, Evaluation, Feedback

Analysis of the system approach to educational technology reveals that the systemic process is a complex methodology, which consists of four integrated phases: planning, implementation, evaluation and feedback. Every stage fulfils a unique purpose and yet is also inextricable from the others, resulting in an endless feedback loop of development. This iterative approach allows ed tech interventions to be sensitive to user needs, institutional environment and changing perceptions of effective practice. Planning is the soul of successful educational technology projects. Effective planning is much more than choosing what each technology to buy or which bells and whistles to add; it involves a step-by-step process of analyzing, considering, and preparing. Profile of His Gal Friday His Gal Friday's digital attentiveness mirrors that of profiled schools. The planning process usually starts with needs assessments, or figuring out the difference between what is and what should be.

Needs could come from data on student performance that points to areas of recurring difficulty, or feedback from teachers reporting on instructional challenges, institutional strategic goals, or outside pressures new standards and accreditation mandates. Doing good needs assessment helps ensure education technology projects respond to real needs instead of trying to come up with problems to fit favored solutions. After identifying needs, preparation consists of extensive analysis of learners, content, and contexts. Learner analysis does not stop at collecting demographic data and extends to include

Characteristics such as cognitive and entry skills, prior knowledge, preferences for learning/gains, motivation level, access or lack of access to technology intermediaries and expertise/training in the use of technology are important considerations. For example, when planning an online course it is important to know whether potential course participants have access to reliable internet connectivity, the necessary digital literacy skills and can make time available for self-directed study or even whether they prefer independent learning as opposed to more social modes of learning. What Must Be Learned Content analysis helps us identify what students must learn the critical information, essential knowledge and skills, processes, attitudes) It also helps us see which of these are foundational and which are advanced; concrete or abstract; simple or complex. This analysis informs decisions about sequencing of content, what kinds of examples and analogies are useful, at what point practice is important, and how to assess for understanding.

Context analysis is the physical, social, organizational and cultural influence on learning. This may encompass real context that takes into account the facilities, such as equipment and infrastructure, needed to perform a given service. The learning context includes the interactions between students as well as between students and teachers. Organizational context relates with institutional policies, resources, priorities and decision making mechanisms. Cultural context refers to the values, beliefs, norms and practices that influence how we define and carry out education. No matter how theoretically or pedagogically sound a technology initiative may be, if context is ignored there is little chance that it will succeed in practice. The one-to-one device program, for example, presents different challenges in a high-wealth suburban school that boasts strong technology support than in an impoverished rural school with little technical capacity.

Planning also requires the identification of focused, explicit, measurable objectives for what learners will be able to do after instruction. Good objectives state what will be performed, under what conditions it will be performed, and how well it must be performed. These goals drive the subsequent planning of content, activities, assessment and technology.

Without clear goals, it cannot be determined upon what criteria educational technology interventions can be judged a success or failure. A good design requires careful study and clearly defined goals, the next step in planning being Design Decisions. They hit on a few different levels at the same time. Then content must be sequenced - usually from easy to hard or known to unknown, the concrete before abstract, the simple before complex. Methods of instruction should be selected according to the instructional goal, nature of content, and learners' needs; they may include direct instruction, guided discovery, co-operative problem solving or independent practice. Media and technologies should be chosen according to their affordances for supporting selected strategies and serving identified needs, including such aspects as interactivity, multimedia, accessibility, scalability and so forth.

Assessment design is a key consideration of coding instruction, as assessment should match closely to objectives and it should be used to communicate progress toward the goal looking both ways back and forward between learners and teachers. Planning involves establishing what will be measured, when it will be measured, in what manner and with which tools, what constitutes acceptable performance, and how results will be reported and used. When planning assessment in educational technology environments both learning intent and use of the application must be taken into account, as how learners interact with a technology can highlight where they might not experience success. Budgeting and prioritization ensures that the financial, human, technological and time resources required for implementation are provided. That involves budgeting for costs relating to equipment, software, training and technical support as well as content production and long-term maintenance. It also means determining who will be responsible for project management, instructional design, content development, technical development, and support during implementation and evaluation. Resource planning has to be honest about what is possible in reality and also inventive in thinking of how to use resources already available and partners.

Risk planning will help to see what might stand in the way and further how such obstacles can be removed. There are various risks that technology projects have to confront, such as; technology failures, resistance from users, poor training for end-users, inadequate support / maintenance, budget overrun, time over-run and change in organizational strategy. Good planning looks ahead to what might go wrong, and makes the necessary provision for how to manage despite challenges. Seeing Is Believing There are so-called research-to-practice gaps in the field, and implementation bridges those gaps. Upon implementation, plans become action–designed interventions spring into being with real learners in real places. The successful application involves taking into account several dimensions at the same time: technical, pedagogical, social or organizational. Technical implementation involves equipment hardware selection and configuration, software installation and setup, network connectivity confirmation, security configuration, and functionality testing. This technical foundation needs to be set prior to learners using the technology, as first-time technical difficulties can lead to frustration and resistance.

Pedagogical realization means designing teaching materials, organizing learner activities, constructing tasks and setting the learning context (the physical or virtual classroom). For online or hybrid learning, this involves developing courses on a learning management system (LMS), generating and/or curating digital content, establishing lines of communication and participation criteria. Under the context of technology infusion in classroom, this means that a planner takes consideration and makes decisions on how the technology will be used well in advance (what kind of technology activities students will engage in and how classroom space will be arranged for using technologies). User training is a key element of implementation and too often insufficient. For both teachers and students, suitable training is required based on their roles and the current competences. Teacher training should emphasize more than technical operation, rather it should also concentrate on pedagogical integration, not only how to use the technology but why it is beneficial for learning and how to best use it for instruction. This usually involves regular, sustained time to practice/reflect with peer-to-peer learning and continuing support.” Student preparedness involves introduction to new technology, skills building and expectations clarification as well help with support. The presumption that "digital natives" require no induction results in failure, as the ability to use social media does not imply competence with educational technologies. Try out with a small group first as at pilot so any bugs can be worked out before anything gets fully scaled. Pilots could be just one class, a group of volunteer teachers or a portion of an institution. When piloting, they collect systematic data on technical performance, user experience, learning outcomes and implementation challenges that inform reiteration prior to scale-up. That said, many problems that could have been solved with a limited pilot become crises at scale without a pilot. Trainee teachers will need in-situ technological and pedagogical support. Technical support also provide help for users experiencing problems with the functionality of technology, whether online or over the phone (help desk), by email, in person or using specific software, where users can log a call. Pedagogical support aids in supporting faculty to embed technology effectively into teaching, such as through instructional coaches, teaching centers, or online communities of practice and collaborative planning time. The first period of impact is especially critical, as it is where users form long-term impressions and support requirements are greatest. Insufficient support during this pivotal moment is a common source of technology abandonment.

Principles of change management guide successful implementation, understanding technology disenfranchises people who must do something differently than they did before. Change management is the art of effectively communicating the purpose and benefits of an initiative, involving key stakeholders in planning and decision making, addressing concerns about changes through resistance management, celebrating early wins and generating momentum by design rather than force over time. Formal change management attention is substantially more likely to make such large scale implementations succeed, especially when so many are affected. Assessment is defined as a systematic process in which the goals of educational technology projects are achieved, and feedback on strengths, weaknesses and areas for improvement can be gleaned. It is important to plan for evaluation from the outset, rather than to tack on an afterthought, with evaluation questions and data collection methods being incorporated into planning along with analysis and reporting plans. Educational technology evaluation often covers more than question: Do the technologies work as they should? Can technology be adopted as it is desired? Are technologies actually being used as intended? Are the intended learning outcomes being achieved by the learners? What is It Like for Learners in the Technology-Enhanced Instruction? What unexpected results, positive or negative, are arising? So what does it take to be successful, and what can get in the way? If so, how to the alternatives?

Formative evaluation is completed during the development and implementation stages of a project, offering feedback to improve the process while it can still respond to changes. In development, formative evaluation may consist of expert review of materials, one-on-one tryouts with representative learners, small group's studies or pilots. Translated in English, feedback from these evaluations is then used to refine the programs prior to its full rollout. During the implementation phase, formative assessment persists as patterns of use are monitored; user feedback is collected; classroom practices are observed and early indicators of impact are tracked. This ongoing formative evaluation informs adaptive refinements, for example adding more training in areas where users have difficulty, revising activities that do not hold learners' attention or dealing with technical glitches. Summative evaluation follows the implementation of the program, assessing overall effectiveness and providing evidence to make high-stake decisions about continuing, expanding, adapting or discontinuing programs. Summative evaluation often uses more rigorous data collection and analysis, such as controlled comparisons of outcomes in the presence or absence of an intervention, pre-post measures of learning gain, cost-benefit analyses, or longitudinal monitoring for sustained effects. In sum, summative evaluation asks if the intervention worked; whether it did so in a cost-effective manner and if we should keep on doing this.

Appropriate evaluation is based on multiple data sources and methods and recognizes that one measure cannot capture this impact of educational technology. Results information from exams, tests, homework and grades are an important source of the what of performance however do not detail why outcomes were achieved. Learning ongoing from LMSs or educational software can provide logs that give indicators of types of engagement, time on task and navigation paths but does not capture quality learning experiences. Cross-sectional studies and focus group interviews provide information about users' images, experiences, and suggestions; however, they may suffer from social-desirability bias or recall bias. Direct observations of real use of technology inform conformance between adoption activities and intentions, as well as between users and technological tools. Institutional data related to retention, progress and completion grant the bigger picture of interpreting learning achievements.

Evaluation should not just look at whether an intervention worked on average but for whom it worked and in what context. Descriptive findings that break-out results for multiple student subgroups can help to identify whether interventions contribute to narrowing (or widening) gaps in achievement. Context analysis examines whether interventions work differently in different settings, with different teachers, or at varying levels of implementation fidelity. Knowledge of such variation is important to scale interventions appropriately and support failing implementations. Feedback closes the loop to the systems-approach cycle with analysis results informing revision, and improvement. Whereas, in reality feedback is not a discrete stage at all but the sinew that connects evaluation back to planning and allows for ongoing evolution. Powerful feedback loops drive the use of evaluative findings rather than its filing; that learning from implementation is an engine for future planning; and that the initiative gets more effective over time.

The feedback loops are working at different layers and scales. Immediate feedback in a lesson also supports on-the-fly adjustment say, if learners appear confused, the teacher can slow down or if practice results in misconceptions then extra examples are appropriate. Can monitor use and performance on a daily or weekly basis to respond swiftly to issues as they arise.” Era feedback on semester or annual basis provides information on major revisions and strategic direction. Longer-term response from longitudinal studies and continuous observation results in trends that were obscured at more restricted time frames. Various stakeholders need various feedback at various points in time. Students require regular updates regarding their progress on the learning objects to allow them to change how and what they are studying. Educator feedback regarding student learning and technology effectiveness can lead to adjustments in teaching strategies and use of technology. Managers need feedback on how implementation is going, how resources are being used and what the results have been relative to a set of goals. Your technical support staff require information on system operation, user problems and enhancements. Information that is part of feedback needs to be relevant to the recipient and delivered in a form that they can easily understand and make use of for informed action.

Cultures of continuous improvement with a focus on value and use of feedback don’t happen by accident. Mental health and service delivery organizations need to make time for reflection on their evaluation findings, incorporate revision and improvement as a routine part of doing business rather than special projects, appreciate and celebrate improvements made based on feedback, and allow there to be such thing as ‘psychological safety’ so challenges in implementation can honestly be discussed without fear of blame. Without this cultural touchstone, feedback systems generate data that sits unused. In the cyclical process of planning implementation and evaluation, feedback is incorporated in the next cycle. Perhaps these early occurrences indicate that learner analysis was not as thorough in some ways as had been desirable, and they prompted more detailed learner analysis to occur during later planning. Challenges that emerged in the implementation may lead to considerations for changes needed in professional development or supports. Some technologies could outperform others for certain goals according evaluation and this can instruct the selection in the future. Through generations, this cycle engenders an understanding ever-more refined and - opposite of cancer-killing drugs providing increasingly precise, often less toxic therapies. Compared with ad hoc adoption, up-front time, expertise and resources are needed for the system approach. But, that's a trade-off worth making in return for greater effectiveness, better results, wiser use of resources and building something that lasts. Systematically introduced technologies are more likely to be applied effectively, to accomplish the intended goals, be supported sufficiently and persist over time. Conversely, tools that are implemented without structured delivery mechanisms generally become expensive doorstoppers, used as minimally or ineffectively but with much less scrutiny of their success in justifying the expense and breeding cynicism about technology for education in general. Finally, the systemic system approach as represented in planning (P), implementation (I), evaluation (E) and feedback(F) is a professional dedication to evidence based practice in educational technology. Rather than gut feelings, the latest trend or simply the salesperson's promise of paradise tomorrow, the system perspective requires us to think it through and work hard especially during our design process. This systematic and disciplined approach separates the profession of educational technology from an atmosphere of techno lust, putting technological capabilities at the service of education (rather than the other way around).

Unit 3.2: Emerging Technologies and Practices

3.2.1 Artificial Intelligence and Machine Learning: Personalization and Intelligent Tutoring

The incorporation of AI and ML into educational systems is one of the most disruptive changes in modern-day teaching. At their core, these technologies are transforming how students learn and which forms of learning educators teach and what education institutions need to do. Central to this shift is AI's ability to analyze big data, recognize patterns and personalize learning in ways not feasible before in brick-and-mortar educational environments. Artificial intelligence in education covers a wide range of applications, from automated grading systems to advanced intelligent tutoring systems that are capable of conversing in natural language with students. Machine learning, a subset of AI that allows systems to improve in performance over time by learning from data without being programmed for specific tasks, helps drive those systems. This is an ability of great value in educational environments where the diversity learners, different learning speeds and personal interests roll together into complicated challenges that previous same-size-for-fit-all models do not handle very well.

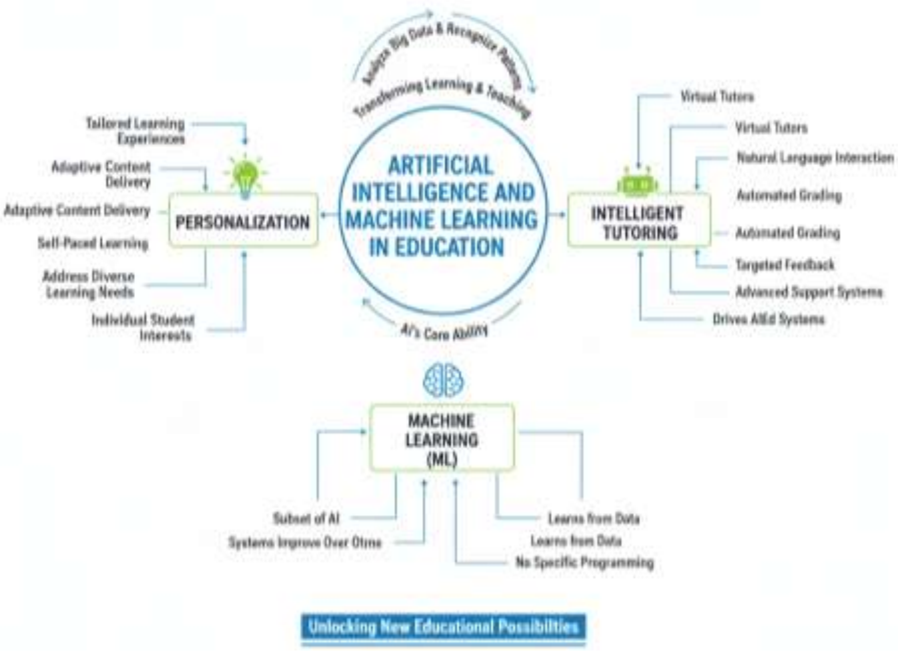


Figure 3.3: Artificial Intelligence and Machine Learning

The idea of individualized AI-guided learning is therefore a significant departure from the one size fits all education model. In traditional classrooms, it's difficult to provide one-on-one assistance for every student when you have twenty or thirty of them or even more! AI-based personalization systems overcome this shortcoming by building a unique learning path for every student, considering their current level of knowledge, manner of learning, speed of progression and interests as well as emotional state experienced during the learning process. Such systems monitor student interactions, response outcomes, and engagement measures on an ongoing basis in order to dynamically adapt content difficulty level, presentation format and instructional tactics.

These personalization engines are driven by machine learning algorithms that recognize patterns of student-educational content interactions. For example, a system could notice that a student has continually had trouble with some aspect of a particular topic, and then give that student extra resources or different explanations for things the system concludes they are having difficulty with to address the gaps in knowledge coverage. Similarly, if a student can master a topic sooner than expected, the system allows them to move on to more challenging material so that they never get bored and continue to stay engaged. This dynamic tuning of the learning experience helps ensure that students are as likely to learn, for example, the definition of an accelerated motion or how atoms combine to form a molecule in polarity as they are more straightforward mechanical concepts such as mass and force at whatever moment it makes sense for them to do so during their educational journey. And human educators alone would not be able to deliver these at this scale.

There really is a lot of nuance to this new personalization that AI can do, beyond content recommendation," says Tabbutt. State-of-the-art systems incorporate natural language processing to interpret questions that students pose in everyday language, cognitive modeling to predict which concepts students are likely to have difficulty with as a function of their learning history, and affective computing to identify frustration, confusion or disengagement using behavioral cues such as typing patterns, response latencies and the frequency of interaction. When used in combination with all of these data streams, AI systems can offer not only the correct content but do so at the right time and format, and with the necessary motivational aspects. ITS might be the most advanced application of AI in personalized learning. They're far more than just passive conveyors of "content"; they engage in interactive conversational dialogues with students, as one would expect from a human tutor. The early intelligent tutorial systems were rule-based and specific to a domain for example, in a subject such as mathematics or physics there was something that could be done through well-defined procedures. Nowadays, ITSs are often based on deep learning and also natural language processing in order to work across different domains and to manage ambiguity and intricacy of human communication.

Consequently, the architecture of contemporary ITSs is usually composed of several integrated parts. The domain model is a repository of expert knowledge about what is to be learned, that is concepts and their interrelationships, procedures for solving problems, and the nature of typical misconceptions. In the student model, a time-evolving internal state characterizing each learner’s knowledge base, misconceptions, learning style and progress is kept. The pedagogical model includes instructional strategies and decision making rules that specify what to present, when hints or feedback can be provided and how learning activities should be ordered. The interface model also includes the student's interaction with system, where natural language understanding leveraged conversational interfaces are becoming increasingly prevalent.

One of the strongest advantages of ITS is its capacity to offer immediate, personalized feedback. There are irrefutable evidence drawn from the learning sciences that timely, goal-specific feedback is amongst the most power factors that improve learning. Yet in a traditional classroom, students may have to wait hours or days to get feedback on their work and the feedback can lack specificity when it comes to correcting misconceptions. Intelligent tutoring systems can detect when a mistake is made, diagnose the student’s underlying cause of the error, and address it with an explanation focused on that problem once it is identified. This immediacy and specificity makes learning go faster and prevents students from practicing mistakes without correction, thereby reinforcing the incorrect mental models.

The successful experience of AI-powered personalization and intelligent tutoring has been well-documented within multidisciplinary research. If afforded the highest quality of intelligent tutoring systems, students could achieve the same level of learning compared to one-on-one human tutors. This type of work has long served as the golden standard of teaching efficiency in educational research. Certain systems in the field of mathematics education, whether it be MATHia from Carnegie Learning, have shown significant achievements in student learning outcomes. In the case of language learning, Duolingo has introduced AI personalization, which is demonstrated to maintain learner engagement and adequately develop one’s skills in various learner contexts. From the perspective of the learner, AI-powered personalization also helps to enhance motivation. It is evidenced that when the work is done in alignment with the learner’s individual drive, challenge, and course autonomy could enhance intrinsic motivation. For example, if an AI system uses story like narrative, topics are engaging to the learner, or it incorporates game elements or projects, this aligns the experience with thematic subjects, which is likely to encourage the interest and effort put into the task. Moreover, personalization at an adequate pace makes learners dependent on their learning experience and self-efficacy throughout mastering the process, which also enhances motivation.

Lastly, integration with AI opens educators many new opportunities since the technology presented may be used as a scared resource for effective practices. Thus, a large body of work has already proven that AI in education boosts learner learning outcomes rather than learners.3942 AI systems may not only automatically check multiple-choice tests but also analyze the performance of an entire class and determine who is behind in a course, leaving teachers with time for valuable, formative tasks like conducting discussions, providing student mentorship, and developing creative learning experiences.

In fact, the AI’s analysis can be then used, making comprehensive reports for teachers on how the learning experience impacts each student in their class. However, there is still room for AI to be more than just an instrument. Nonetheless, the inclusion of AI in education is not exempt from problems and risks that should be carefully considered. Data privacy and security are important concerns since these systems gather a large amount of information about people, such their learning process, performance and even behaviors. Investments in advanced AI should not just increase privacy concern for schools: the solution lies in whatever you do with the data Automated theoretical machine learning within this main challenge’s scope involves massive investment in computation power to store and analyze training data, so that students can opt for how they learn instead of decide what collects information on them. Questions about who owns student learning data, for how long it should be kept and for what purposes it can be used need clear policy answers, as well as transparent communication with students and families.

Another pressing issue in AI-driven educational setting, is that of algorithmic bias. Machine learning models are trained based on history, so if we provide them with biased data, the models will likely reflect and can even amplify these biases in their recommendations or decisions. For example, if an AI program is trained mainly on data from one demographic group, it might not be working as well for students of other backgrounds. Educators and educational AI system developers should take the bias inherent in even uninfected systems very seriously by proactively seeking out and addressing it through a multi-stakeholder design process that brings in diverse perspectives as well as regular audits of the system’s outputs. The issue of transparency and interpretability in decisions made by AI is particularly relevant in education. Students and teachers both benefit from having a better understanding of why the AI model made that recommendation why, for example, it suggests a certain learning path or offers certain feedback. Also, black-box algorithms that don’t justify their decisions can understandably generate skepticism and erode trust in the system. The area of explainable AI is tackling this issue by creating tools to render the outputs of AI systems more understandable, a particularly important endeavor in high-stakes educational applications that impact the learning outcomes and academic trajectories of students. There are equity and access considerations that one must keep front and center when using AI in educational technologies. Characterized by significant potential for personalized learning, these tools can also deepen educational inequalities when only students in well-resourced schools have access to them. The digital divide involves not just access to devices and internet connectivity but also the technical infrastructure, teacher professional development, and ongoing support required for successful implementation of AI systems. Policy makers and education leaders need to actively strive to make AI accessible, regardless of a student's family income or where they live.

Human judgment and teacher-student relationship continue to be irreplaceable deep into AI systems' sophistication level. Education is first and foremost a human activity, not merely the transmission of knowledge but a process of social-emotional learning, character development and citizenship formation. Teachers supply role modeling, emotional support, motivation and the kind of human rapport machines can't match. The best applications of AI in education acknowledge this truth and treat technology as an aid to human teachers rather than a replacement. The aim must be hybrid intelligence environments where AI systems enhance rather than replace the irreplaceable strengths of human teachers. Beyond, there is a brave new world of AI coming out and it will have even more impact on education. However, breakthroughs in natural language processing are allowing AI systems to have more complex dialogues, understand context and subtlety and infer explanations comparable to human tutors. Indeed, multimodal AI systems capable of understanding and integrating text, speech, images and video present opportunities for more immersive and accessible learning experiences. Generative AI models can also generate personalized learning materials, practice exercises, and evaluations that are customized to fit the specific learning needs of each student based on their individual strengths and weaknesses. As these technologies continue to develop, the possibility of genuinely responsive, adaptive and successful personalized learning environments becomes more likely. Successful implementation of AI and machine learning in education will depend on careful planning, regular assessment, and dedication to maintaining human values and learning outcomes at the core of technology deployment. Schools and universities need to have a clear vision for how AI will support their pedagogical objectives, provide the professional development needed so educators can work effectively with AI systems, and put in place assessment mechanisms to monitor the impact on student learning. If done with a keen eye on the possibilities and challenges ahead, artificial intelligence (AI) and machine learning stand to bring high-quality, individualized education to every student, rather than have that type of personalized instruction modeled only for those who are most privileged.

3.2.2 Blended and Hybrid Learning: Combining Face-to-Face and Online Instruction

Hybrid learning, or blended learning, is an instructional approach that purposefully incorporates both face-to-face and online teaching to create a seamless and integrated classroom experience. What began as a novel concept used by many forward-thinking institutions has now become mainstream, with schools around the world incorporating some form of online learning into their curriculum. The COVID-19 has forced this fast adoption in an unprecedented manner, making educational institutions develop very rapidly their flexibility for blended learning, but then at the same time it shows that there’s a lot potential and a lot challenges within this type of instruction.

At its essence, blended learning is not just about adding computers to the classroom or alternating between online and face-to-face options. It’s not about technology replacing teachers, but an entire way of thinking differently about how student can learn that incorporates a face-to-face and online component in which each modality is utilized to focus on what it does best. The F2F part offers socializing opportunities, interaction, hands-on experiences and immediacy of feedback and the human element that is essential to learning for real. The course also has an online dimension which is flexible, self-paced and it includes rich multimedia resources for learning, reflection activities and customized learning pathways. When intelligently put together, the effect is more than the sum of its parts. There is a wide spectrum of blending learning designs, which differ in the amount of face-to-face and online (virtual) content and modes to combine these modalities. In the rotation model, students rotate through learning modalities on a set schedule. In a station rotation, students move between multiple stations within a single classroom, at least one of which is an online learning station. Online learning in a lab rotation, in which students rotate between a traditional classroom and a computer lab. In the flipped classroom, traditional lecturing is reversed with students learning the lesson in homes and doing homework (learning practice) at school. In the flex model, most instruction is provided online with teachers helping face-to-face as needed. The a la carte model lets students take some classes completely online while going to physical schools for others. The blended virtual model is made up primarily of online and some in-person courses.

The flipped model has been drawing special attention as a new blended learning method to tackle issues of traditional education for a long time. In traditional instruction, teachers teach lessons during class sessions depriving valuable class time while the students they did practice and apply with homework but with little or no supervision in case of difficulty) In the flipped model, that order is reversed: students interact with new material before class (through videos or readings) and then use class time for active learning exercises, which might include doing problem sets or discussing the ideas in small groups while getting feedback from the teacher. This method is moving the teacher from sage on the stage to guide on the side and making learning more active and interactive than passive.

Studies of flipped classrooms to date have returned mostly positive results, with effectiveness strongly dependent on the quality of implementation. Also Morning side college students say they'd like to learn at their own pace and even pause the professors. Class time is turning into what should be a more interactive and engaging time, with students doing things with their learning, rather than simply picking it up from the teacher. Struggling students can be more readily pinpointed during in-class exercises and offered targeted help. Yet, effective flipped classrooms demand thoughtful planning of its online and classroom elements as well as access to video resources of high quality; clear articulation about the expectations for use; and strategies that promote active use of pre-class material. One of the great benefits of blended learning is its accessibility to varied students. This allows students to connect with online components at their convenience, say from home of the parent or relative keen on her weather, which can be handy to non-traditional students juggling education and work or family. For students who need to hear or see things multiple times before they understand them, this is a good way for you to really reinforce your learning; for those students that pick up on new information quickly and would benefit from exposure to more challenging levels of exercises, it allows you the opportunity to move ahead. And students can experience content in the way they learn best, whether it's through text, video, interactive simulations, or audio. This flexibility is a gateway for proportionate access to education, therefore students can interact with the educational process according to their own situation and conditions.

The online part of the blended learning educates access to resources and experiences that are not feasible in a completely face-to-face setting. Here they can interact with virtual labs, simulations of complex systems or field trips to anywhere in the world as well as opportunities to connect with experts over video conferencing and access huge digital libraries. These additional assets can also help to enhance the learning experience and make students ready for a world where much of work and learning takes place online. The mixture of multimedia, interactions, and adaptive technology within the online portion may have fostered greater engagement and customization of learning styles beyond those found in traditional textbook- only models. More targeted differentiation and personalization can be accomplished within the confines of classroom based instruction by using blended learning. Class time serves the whole group, but the online portion enables each student to work with different content or at varying paces and levels of support depending on need. Online modules can be assigned to select students, or they may be supportive materials for those who need more assistance and challenge options for students who are further along. Such individualization is very challenging to handle in an exclusively face-to-face setting but does become a controllable task when supported by LMSs and adaptive online systems. Data collected from online learning activities is a rich source of information about student learning which can be useful in making instructional decisions. Teaching management systems log when students open materials, how long they spend on tasks, which resources they access, and how they perform on other activities or assessment questions. This information provides teachers with visibility into student engagement and understanding that can be elusive in traditional face-to-face-only settings, where much learning happens in private outside the physical classroom. Teachers can pinpoint which students aren't interacting online, who may be wrestling with particular concepts and trends across the class that might indicate it's time to make instructional changes. It’s an evidence-based solution to be more responsive and a better teacher.

The opportunities to learn from each other in blended situations can be particularly strong when there is a good alignment between online and face to face tools. Discussion Boards Discussion forums provide a space for dialogue that is deliberative and contemplative in nature, allowing students to think about their responses before sharing them with the entire class as they might do so fast in an in-class discussion. Documents facilitate asynchronous collaboration, allowing students to collaborate at different times and providing a record of the collaborative experience. Video conferencing can bring students together with peers or experts in other locations. With online collaborative tools combined with face-to-face teamwork, students acquire flexible collaboration skills for the hybrid working environments that are common today. Yet rolling out successful blended learning is not without challenges. Most obvious is the possibility of blending face-to-face and online instruction by recruiting additional lecturers for those who want a more personalized focus to teaching or integrating wholly online elements, such as Flip Teaching, into non-digital teaching methods. Successful blended courses are based on a course redesign that plans for the synergy between face-to-face and online components. The choice of each element should be based on which modality best addresses that particular learning objective, and not use a technology just for the sake of it. Digital inequity is a significant issue in blended learning environments. Students must have consistent, reliable access to the internet, appropriate devices and an optimal setting in which to learn online resources that are not universally accessible. With large portions of learning being conducted online, students without proper access to technology are underprivileged. These need to be addressed by educational institutions that have introduced blended learning, through provisions for lending devices, providing hotspots and on campus spaces for online work and ensuring that the irreducible minimum of necessary learning can happen in a context where technology access is poor. The idea that all students have the same access to technology and communication at home can compound disparities in education.

Faculty development is also one of the most important issues for successful BL. Good teaching in a blended environment involves a different skill set and pedagogy than that used in traditional face-to-face teaching. Educators must become familiar with developing interesting online content, moderating online discussions, successfully employing LMSs, interpreting learning analytics and redesigning courses to build in hybrid (i.e., blended) courses both face-to-face and online portion strategically. This sort of professional development is time-intensive and requires sustained support, not just a one-time training. Institutions must commit resources to holistic faculty development programmes, understand the amount of time it will take to redesign courses and establish communities of practice for peers to exchange tactics and knowledge. Preparedness of students for blended learning is highly variable and cannot be taken as given. Some students love the freedom and versatility that online pieces offer, while others struggle to regulate their own schedules or find motivation in a less structured learning environment. Others may find themselves unfamiliar with learning-management systems, online collaboration or the expectations for academic integrity in an online environment. Successful blended learning initiatives incorporate orientation activities that teach students the skills and habits needed to succeed, as well as clear expectations and structure, along with resources for students who experience difficulty in an online environment. The quality of the content and activities online is critical for effective Blended Learning. Badly designed online elements that provide no more than uploaded transcripts or poor quality videos are a turn off to students and are not facilitative of learning. Good online components need to be interactive, well-crafted, well-orchestrated and obviously linked to the targeted learning objectives. Practice, self-assessment and feedback should be embedded in these activities. Making good online content is time-consuming, skilled work that quite often demands tech support and resource from educational bodies. But this investment is essential to ensure that blended learning realizes its potential, rather than being a watered down version of the sort of traditional instruction that has clunky techiation bolted on.

Assessment in blended learning context is an issue to be pondered. The ability to access information online for tests begs the question of how do you evaluate "authentic" learning as opposed to looking up facts fast? This limitation nevertheless could also been seen as an opportunity to move towards more authentic and application-based assessments that demand higher-order thinking skills, not only remembering. Approaches such as portfolio, project with peer assessment and reflection can be more authentic-learning friendly within blended contexts than conventional examine. The online resource also enables more frequent low-stakes assessments, which foster learning without significantly increasing the grading overhead as these can utilize automatic or self- assessment tools. The social and emotional elements of learning in blended spaces should be considered. Though online elements are a boon for many, they can come to feel cold and alienating if not counterbalanced by the chance of more human engagement. Students need to feel that they are part of a learning community, not just ingesting content on their own. Thoughtful blended learning cultivates community through purposeful face-to-face contact, online discussions that facilitate personal connections, collaborative work and teacher presence in both environments. Facilitators must also be available in online spaces (Mott, 2010), to create a sense of being there and maintaining presence even though we are not with our students in face-to-face environments. Peering into the future, it seems that blended instruction might stay common rather than going back to traditional face-to-face means of teaching. Forced to make a rapid digital transformation during the pandemic, however, just as employees have found during the past two years about work from nowhere and remote work, schools learned both what's possible of online and hybrid learning and also its limitations. Most teachers and students understand that there are real benefits to a thoughtful blend, while acknowledging the irreplaceable features of meeting face-to-face. The future of education is probably flexible, student-centered hybrid models that use technology to amplify rather than supplant human contact or active learning. Attaining success will require us to remain focused on equity, quality, faculty development and intentional integration of modalities in support of well-articulated learning outcomes.

3.2.3 Cloud Computing: Accessibility, Storage, and Collaboration

Cloud computing has revolutionized the technology behind education by replacing locally installed software and in-house servers with internet-based applications offering robust features available anywhere on-line. This transition goes much beyond just a move in the location of data and applications; it constitutes a fundamental reshaping of how ed-tech is deployed, governed, and flexed. "The power relationship, in terms of who has access to really sophisticated tools, isn't the way it used to be, so that a relatively poorly resourced institution could have very fast access to some pretty serious kit," he says. "We will start seeing ways of learning that are opening up not just around where we learn but how we share information.

Cloud Computing at its simplest is a form of computing that delivers services via the internet, it includes storage, databases and servers as well as software however rather than accessing this from local computers or your institution you access these abilities through the cloud. These are the services that are offered by cloud service providers which operate large data centers full of redundant servers, backed-up secure storage and professionally managed systems. These services are available on demand to schools and individual users, often via the purchase of subscription models that permit them to utilize resources proportional to their requirements without having to make hefty initial investments in hardware and infrastructure.

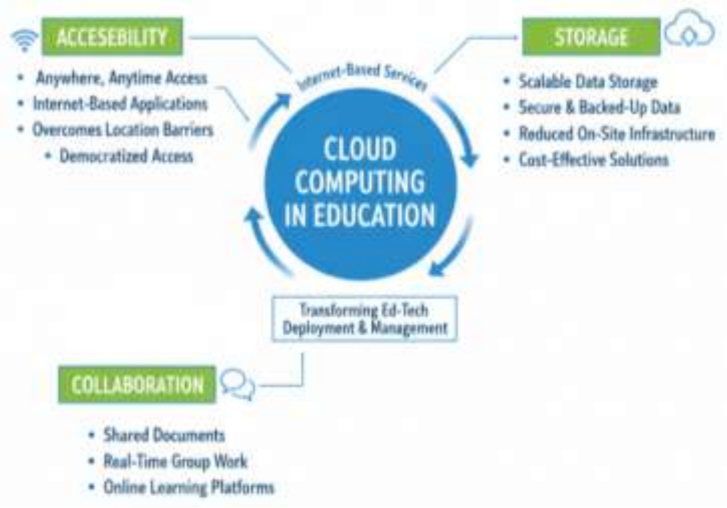


Figure 3.4: Cloud Computing

The advantages of cloud computing in education for access are far reaching and varied. Geography is far less of a barrier to educational content when both content, tools and services are in the cloud. A student in more remote location where there are not a lot of local educational options can access the same cloud-based learning environments, software applications and collaboration tools as a student at an urban school with better resources. This geodemocratization is worldwide, allowing even pupils in third world countries access to educational materials that could never have been distributed in the traditional way. All one needs is an internet connection, and though the digital divide in access to that remains steep, the barrier for entry and exposure to world-class educational tools–has never been lower.

Device independence is another important accessibility benefit of cloud computing. With applications and data in the cloud, rather than on a device, students "never worry about work being lost when their device fails," Mr. Shultz said in an e-mail message to me. And now that's at school computers, laptops at home and even tablets in the library or with smartphone access soon. This flexibility is of critical value for students who may not always have a PC to call their own, but can reach PCs in shared collections. The work you started here can be completed there without frustration of files not in reach because the other computer is a different one. "That seamless transition between channels allows more of a continuous learning stream with less of an artificial break that often happens because we are waiting for technology to catch up. It also accommodates access to learning for disabled students in a way that the traditional technology model has not been able. Cloud-based accessibility software can be accessed on any device, providing at-risk students with the right tools when they need them. There are services (including in-screen readers, speech synthesis and recognition, resizable text management and methods for alternative input) that can be built into cloud applications or added as services. Cloud platforms are centralized, and it is relatively straightforward for carriers to enforce that accessibility features be preserved and updated, and that content is designed with accessible in mind.

There is also the little matter of the economic reality of cloud computing. This traditional educational technology also demanded that institutions invest in the purchase of software licenses, maintenance of servers, requirement for IT staff to run system administration and regular hardware upgrades as well as securing and backing up data. These expenses made it so that schools could not afford advanced educational technology, especially those for students living in impoverished areas. Cloud computing transfers them instead to subscription-based rates that are frequently cheaper and more predictable, with the burden of maintaining, securing, and operating equipment shifted to the cloud provider. Free or low-cost cloud services, especially for education, have meant that powerful tools such as Google Workspace for Education, Microsoft 365 Education and a huge range of learning management systems are accessible to schools with little budget. Cloud computing in educational technology a long-time problem for educators has been trusted storage. Both students and teachers are producing massive volumes of student-created digital content such as documents, presentations, digital projects and research. Keeping such information on each individual device is restrictive and risky (what if you lose or damage your device?) and sharing such things can be painful. Cloud storage gives you massive storage space, and it lets you create automatic backups to avoid loss of data and have access to the version history that holds previous versions of documents. Students never need to worry about losing their work, should the computer crash or flash drive be forgotten. Teachers can conveniently collect, review and grade student work in a digital form without needing to manage boxes of physical storage media. Cloud storage unlocks the power of your data more than just a place to put your files, cloud storage delivers strategic and foundational value. Cloud services provide strong organization abilities with folders, tags, search functionalities, and metadata which makes the retrieval process a breeze of few clicks among thousands of resources. Students then have easy access to months or years' worth of portfolio examples. Teachers are able to develop resource libraries that they can continually tweak, instead of beginning from scratch each semester. Institutional memory can be kept and passed along to new faculty instead of lost upon departure. This organizational capability stimulates learning to be built systematically and recorded, instead of being temporal and partial.

Collaboration is arguably one of the most powerful agents for changing practice in relieving some potential instructional barriers of cloud within education. Before cloud-based collaboration tools, working on digital documents together was a slow chore that usually meant emailing files back and forth, trying to reconcile different versions and getting caught in never-ending discussions about which version was now the current one. What is the best tool for collaborating on a document in real-time? This facility will end up defining collaboration to the most fluid, efficient and truly collaborative (versus sequential) workflow possible. Cloud platforms and real-time collaboration are driving new kinds of active learning and pedagogy. Students can brainstorm by contributing to shared documents, developing ideas in tandem as they would in professional practice. They also make group projects a real collaboration in which everyone work at the same time instead of breaking it into separated pieces which are put together at the end. The peer review process and the editing process become a practice of learning to give feedback directly on the shared work, so that students are not only seeing final products but witnessing writers' collaborative practices.

As this collaboration happens teachers are able to watch from the side of a classroom, guide book and judge not only what is achieved but how well they collaboratively achieve it. Cloud-based collaboration tools bring transparency and documentation, which we learn from. Most cloud services offer some form of revision history, which details who changed a file and what changes were made, as well as when those changes occurred. This transparency aids accountability within group work where teachers and students can witness the contribution from each member. Most importantly, the power of looking at a system over time is that it can visibilize work in process for reflection. Students can even go back to see how they developed their thinking, what methods they tried and abandoned, how their work improved through revision. Such metacognitive awareness of the learning creation process is important for gaining higher-level understandings about how knowledge is produced.

Cloud collaboration is much more than creating a document. From joint display programs and video creation services, to virtual whiteboarding apps or mind mapping software, all the way up to advanced design tools collaboratively setting facts down exists in a server again. This variety of practical tools allows for different learning styles, subject areas and types of projects. Students can work together on videos, websites, data visualizations, compositions or scientific models they create in the cloud–and do so wherever they may be. The cloud collaboration environment's global availability allows for the potential of linking learners on different sides of the world -and culture. (We're used to students in different countries working together, exchanging views and building their intercultural skills using cloud, Continue reading Yes You Can! Combining Connections and Tools in the Cloud to Create a Common Learning Space across Nations by Dennis SEDMASIER, Sandra Ludwig, Doreen Adebiru-Lawal and Susanne Müller-Using) Cloud-based virtual exchange programs bring cultural experiences to students in a way that would otherwise be prohibitively expensive or logistically extreme. These global connections will make them prepared for a world where much of our professional work is done collaboratively with distributed teams based in disparate locations and time zones.

In addition, cloud computing offers heavy features in content management and delivery to education industry. Cloud-based Learning management systems offer a platform for teachers to create, store and distribute course content, post/pass out assignments, conduct discussions/exams, assess students' work and monitor student progress. These applications work with other cloud-based services so teachers can insert documents, presentations videos and interactive content seamlessly. Changes to materials are automatically made available to all students, so no more outdated handouts or lost papers. Communication tools in cloud LMS enable the consistency of interaction between a teacher (instructor) and learner to be documented.

For educational institutions, the scalability of cloud computing is especially critical. When demand surges, for example during high-stakes testing windows or if all students are working from resources at same moment, cloud infrastructure can expand to accommodate that demand. On the flip side, institutions are not funding overbuilt infrastructure to sit idle during low demand such as summer breaks. This flexibility makes it possible to implement advanced educational technology even in less-populated, resource-strapped schools. New program or initiative starts are possible without the need for long procurement and installation timeframes for new hardware. On security and privacy in the cloud, organizations are profiting from the investments and specialist skills of major cloud service providers in a way that many educational institutions cannot replicate. Data loss can be prevented using advanced security precautions such as cloud-encrypted storage, in multiple physical locations, with access controls and means of detecting intrusion. There are professional security teams who stand guard for threats all the time.

Institutions will still need to enforce good data governance, but the security architecture at most companies is far more sound than what schools themselves could afford to deploy. This does nothing to diminish the importance of thoughtful policies around data privacy especially if you have sensitive educational records to protect, and are subject to specific student-related data protections (such as FERPA in the US or GDPR in Europe).

But for all its benefits, cloud computing in education is also subject to many challenges that need careful consideration. Probably the most basic is reliance on being connected to the internet. Without offline access to cloud services, when the Internet goes down, students and teachers become immediately disconnected from their work, resources and tools. Some cloud apps may have modes that work offline, and then automatically sync once you're back online, but there are also many cloud-based solutions that require an active internet connection. This dependency if further aggravating existing digital divide problems as students in places with unstable internet or lacking home internet are put at serious disadvantage in cloud computing-based educational systems. Data privacy and security aspects, although partially served by the cloud infrastructure has however new issues to consider. When such data sits on servers maintained by third-party providers, questions emerge about how that data will be used, who can gain access to it, for how long it will be held and what happens to the data if an institution changes vendors or that vendor goes out of business. Schools will need to carefully scrutinize cloud-based services providers' data handling policies, contract terms for compliance with relevant laws and contractual terms regarding ownership and use of the data. We can't trade off the usability of cloud services against student privacy or inappropriate commercial exploitation of educational data.

Another problem is vendor lock-in. Systems and processes being designed around a cloud platform create a lock-in where they become hostages of that cloud's data format, meaning it is difficult to move anywhere else because transitions would mean people need re-training, systems have to be rebuilt and there will be break in best practices. This lack of freedom can keep institutions from having negotiating power and put them at risk if providers raise their prices or change the terms of service. Selecting cloud platforms that preserve portability and interoperability, such as using portable data formats, can help to reduce the apparent concerns, but this involves technical decisions at an early stage. The cost structure of cloud is sometimes more transparent than legacy IT infrastructure, but can be as costly at scale, especially when institutions become heavily entrenched in them and ramp up usage. A small subscription fee per user or service may not seem like much, but add it across

Thousands of users and services. Higher ed institutions are taking a very hard look at the actual cost of ownership, not just subscription fees but more around what it means to train their staff, and costs to integrate this product taken into consideration. The belief that cloud will always be cheaper doesn't necessarily apply in every case, especially for organizations with infrastructure and skilled resources in place. Don't underestimate the digital literacy and change management issues associated with cloud adoption. Students and their teachers and school leaders need training not only in how to use individual cloud tools but also around broader themes, such as digital collaboration, data management, online safety and academic integrity when working or studying in the cloud. It is inevitable that there will be resistance to change from end users who are accustomed to traditional tools and workflows whether or not those perceptions of limitations are real and perceived. Cloud computing is just as much about people and culture as it is about technology.

For the future, cloud computing in education will grow and become further rooted. Upcoming trends are edge computing which processes some data near to the end users for higher performance, artificial intelligence services in cloud providing advanced services without local processing power and growing integration between educational cloud platforms and other systems using APIs/standards. The shift toward cloud-based edtech is clearly here to stay, it’s not just a trend – the aspects of accessibility, communication and flexibility are all in line with society’s current needs and activities.

3.2.4 Learning Analytics: Data-Driven Insights

Learning analytics is the collection, measurement, analysis and reporting of data about learners and their context in order to understand and optimize learning and the environments in which it occurs. The field lies at the edge between data science, learning sciences and educational practice, with potential to render visible processes hidden in traditional teaching and towards empirically-informed decision-making over just humans intuition. Such analysis opportunities have dramatically expanded as the educational tasks are more and more done in digital environments that automatically generate data about students' interaction, performance and engagement. The scope of data used in learning analytics is wide and ranging from the simple to complex. Simple metrics are log-in frequency, learning-activity time consumed, assignment-completion ratios and test scores. More advanced data might include details on which learning resources are clicked, clickstream tracking of student navigation through learning materials, resource usage patterns, follow-up and participation in discussion forums and social network analysis as well as times to respond and typical error patterns from assessments; even biometric data is available via wearables for measuring attention [and stress] levels. Writing analytics have the potential to review students' writing processes, such as their types of revision and argumentation development. Multimodal learning analytics integrate data from different modalities such as text, speech, video and movement in classroom to draw more complete pictures of the process of learning.

The allure of learning analytics is the promise of being able to render visible what was previously vague about how and when people learn. Where learning was predominantly through lectures and paper-based study, teachers would have had little visibility over how students were actually interacting with content between classes, where they found the material difficult or how they were approaching it. Digital learning environment leaves traces for students activities which are not discernible directly by human eyes. Analytics can reveal the sections of online lectures that students watch repeatedly, which could highlight confusing concepts that require deeper explanation. They can also differentiate between students who are using them a lot but not doing well, they aren't just an engage mental factor. They can tell us that students who post to discussion forums do better on quizzes, implying the value in doing so. Predictive analytics is a use of machine learning algorithms to learn from previously collected data and predict the likelihood of a similar outcome occurring in the future, like predicting which students may fail or drop out of a course or require additional aid. Predictive model driven early-warning systems, have the potential to notify teachers as soon as a student starts straying off their normal behavior, allowing them to intervene before it becomes unreachable. These forecasts might be based on various things: Attendance, submission of assignments, how they performed in the grade book, the library usage and use of learning management systems. Not toward hopeless prediction, but opportunity for timely support that can change the course to more successful outlooks. In higher education, predictive analytics have been used to address student retention, an issue that is critical for student success and institutional stability. Models can predict, however, which first-year students are likely to be at higher risk of failing to return in their second year based on early signals like those grades and engagement patterns as well as specific demographic characteristics. The academic advisors can then target contacting these students and referring them to services that will support the factors putting them at risk: crash courses in academics, tutoring, financial aid advising or social connections. Studies have shown that directed interventions can improve retention rates when they are timely, tailored to the individual and linked with needed resources.

Intelligent learning systems tailor educational experiences to the individual student in real time, using learning analytics. As students use these systems, algorithms monitor their answers continually to detect misconceptions or learning gaps and subsequently adjust the difficulty and order of instruction. A student who ‘gets’ a concept can move on to harder material; a student who doesn’t can have more practice and different explanations. Through this adaptivity, and in ways that read as though a teacher were changing each student's personalized learning pathway by hand (and so for an entire class would be impossible), V2P ushers into edtech, at scale, the benefits of personalized tutoring. Learning analytics also contributes to curriculum design and the ongoing refinement of learning resources. Examining patterns across large numbers of students lets educators see which learning materials work best, which assessments are most predictive of learning and which course sequences yield the best results. Problem areas of online courses that lose the most students can be identified for revision. Test questions that an overwhelming majority get wrong could be badly-worded, or point to concepts that require improved teaching. A/B testing methods, commonly used in industry, can be used to compare different versions of learning materials and empirically measure which leads to better learning. This iterative improvement, which is evidence-driven in nature, can systematically evolve educational experiences to make them more effective over time. The social dimension of learning can be unmasked by using social network analysis for interaction data originating from discussion boards, group works or collaborative learning. These analyses can serve to uncover interaction patterns, recognize isolated students and bring attention to highly connected students who could potentially serve as peer leaders. The social structure of learning communities can guide instructor interventions in the service of more inclusive collaboration, and to make sure that all students get something out of interacting with their peers. It has been found that students' location in social networks within a course are related to their learning outcome, with the more central located students, i.e. have many connections with other students, being likely having better outcomes.

Learning analytics dashboard visualize data to help educators and students understand intricate patterns. For teachers, readouts might reveal patterns of engagement across the class, who was struggling, which learning objectives students were excelling at or struggling with and how their current classes' performance compared with that from a year ago. Dashboards for students can give feedback on their progress against learning objectives, visualize how engaged they are relative to successful students and indicate where more effort may be required. Good dashboards show data that can be acted upon in a clear, intuitive manner but without overwhelming the user with detail (but enough to make them smart decisions). Leveraging learning analytics to promote self-regulation and metacognition of students is a promising yet under-explored usage. Students are able to (STORY) get feed- back on their learning behavior and learning pattern as a result of it being clear to them and can then make more informed commitments regarding how to learn effectively. Evidence that a student crams more before an exam, but does better on material read throughout the semester, presented in a dashboard can incentivize action to change study habits. Visual feedback on progress of learning can support learners in setting goals and checking whether the measures they take lead to expected results.

This transparency promotes metacognitive skills and self-regulated learning strategies that serve students in any course. Despite its potential, learning analytics presents major ethical concerns that need to be carefully considered. Privacy "In the mainstream, the privacy concerns are big because analytics involves detailed tracking and analysis of student behaviors and teacher performance, as well as potentially sensitive personal information," said Siemens. In this new era, it is important to let students and families know what data will be collected; how it will be used; who has access to the information; and how long that data will exist. Consent processes needed to be meaningful rather than buried in dense terms of service no one reads." Institutions must weigh the value proposition of analytics against students' legitimate privacy expectations and develop robust data governance mechanisms to prevent abuse.

Algorithmic bias is a risk in learning analytics systems similar to that in other applications of machine learning to human decision making. "When you train your predictive model on 200 years of data that embody systemic inequities, you will calculate those biases out and bake them into the system even more," she said. For example, if particular demographic groups have historically seen lower completion rates because they were underserved rather than underqualified, a model may wrongly conclude that students within those demographics are high-risk when the underlying issue is systemic obstacles. Developers of learning analytics systems should proactively look for and correct bias, conduct periodic audits of system outputs to check for disparate impacts, and acknowledge that prediction efficacy is no guarantee of justice. Transparency and explainability are issues of crucial importance in learning analytics tools have an impact on high-stakes educational decisions.

When an analytics engine signals a student as being at risk, or suggests to turn left up ahead for better instruction results, the humans that this effect addresses (educators and students) need to know why this did. Trust will be reduced in black-box algorithms that are not able to provide a rationale for their action and may result in incorrect reliance on or ignoring of the system. Furthermore, fairness principles should dictate that when students are subject to algorithmic decision-making brought about by the use of procedures they must be informed of the underlying process and have a chance to challenge decisions in which they believe there has been an error. There are practical risks to making effective use of the analytics data, because it can easily be misinterpreted. Correlation is not causation, but it's a short jump to say one causes the other. "They found two things associated with each other," said Prof. Andrew Gelman, a statistician at Columbia University. For instance, learning analytics could show that students who use a specific online resource often are doing better on exams However, that doesn't mean that the resource caused the performance improvement; they could each be effects of some underlying level of motivation on the part of the least motivated or ability on the part of the most able children. For those interpreting analytics, statistical literacy and critical thinking is required so that conclusions are not made on the basis of misinterpreted data nor interventions that do more harm than good.

The emphasis on monitor able behaviors and outcomes in learning analytics might, unintentionally, constrain educational aims to what is readily quantifiable yet overlook dimensions of learning that are not easy to measure but deeply significant. Things like critical thinking, creativity, empathy, ethical reasoning and wisdom don't always translate easily to checkboxes in a learning management system. When the analytics in use restrict instructional decision making to focus on completion rates, time-on-task, and assessment scores there is a danger that service units will lose sight of the overarching purpose of education. Learning analytics may inform, but should not supplant human judgment about what counts as meaningful learning and valuable educational experiences. The implementation hurdle of taking analytics to do anything with learning is nothing short of monumental. Data can be created, and reports written, more easily than knowledge that can drive interventions with meaningful impact on outcomes. Predictive models could be used to pick out students at risk, but if there are no resources or mechanisms for supporting those students then the knowledge itself does nothing.

Teachers may have dashboards that display worrying patterns of engagement, but if they don't have the time, skills or resources to respond to them, then the analytics are useless. It's not only technical infrastructure, but organizational capacity, teacher professional development, culture change, and resources to act on the insights that are generated. With respect to whether and how this imbalance in power should be recognized, we argue that the question of agency (and risk) due to analytical interventions is an important one. There is the possibility of a self-fulfilling prophecy when students are identified as “at-risk” based on algorithmic prediction, where latter down the line they may internalize low expectations or find themselves taught to lower standards. Analytics interventions need to be positioned as support and opportunity (not remediation) and predictions treated as a material input, not deterministic claims about student capacity. Ultimately, we would like for students to be in control of their paths, not overly constrained by algorithmic suggestions. It’s about empowerment rather than control.

Into the future, the potential for learning analytics is to become more advanced through marrying other technologies such as artificial intelligence, employing richer data sources involving multimodal information and operating at different levels from individual learners through classrooms to institutions and educational systems as a whole. In addition, real-time analytics will allow for a much faster response but that also puts more emphasis on the need to make sure automated interventions are both correct and applicable. The field has to grow up, not just technically, but ethically, supplying ethical guidelines and best practices that guarantee that analytics serves humanistic educational values and does not boil learning down to a process of optimizing measurements. The most significant potential of learning analytics is not to supplant human judgment, but to extend it with evidence that could not be known before. Applied thoughtfully with a focus on values such as ethics, privacy, equity, and the ultimate ends of education, analytics can make educators more effective, enable institutions to allocate resources more strategically and empower students themselves to take more control over their learning. We have a ways to go before that promise is fully realized, yet we can only realize this promise if we critically reflect on our instruments of measurement –what it is that we’re measuring; why we measure the way we do; and how to ensure that such data-driven insights help serve the end goal of meaningful learning for all rather than just more impressive score tallies, or reproducing existing patterns of inequality.

3.2.5 Adaptive Learning: Customized Learning Paths

Understanding Adaptive Learning Systems

Adaptive education is an example of a recent category of educational technology for behavior change, moving from one-size-fits-all situations, to highly personalized learning experiences that adapt its response to each student's need and capabilities. At its simplest, adaptive learning entails the use of complex algorithms, artificial intelligence (AI), and big data to design personal learning paths that change on-the-fly according to how learners are scoring, how engaged they are, and whether they're comprehending. This acknowledges that each student has individual cognitive capabilities, background knowledge, learning styles, and pacing needs therefore one-size-fits-all instruction is inherently limited in its efficacy. At the heart of adaptive learning systems are ongoing evaluation and feedback cycles. As students engage with the learning platform, data is accumulated in relation to their responses, time spent on tasks, errors made and problem solving strategies utilised. The data is processed with machine learning to detect where the knowledge gaps, misconceptions and strengths are. Instead of relying on one-off assessments, adaptive systems are able to formatively assess students regularly and thereby have a more complete picture of each student's strengths and challenges. This continuous assessment allows the system to decide on which contents must be delivered, which level of difficulty best adapts to the student skills and how the course should teach or use additional resources, in order to achieve an optimal learning response.

The personalized learning-path mechanic

The generation of personalized learning paths is a complex decision problem where different variables must be taken into account at the same time. For a user who starts taking a course or module, the adaptive is generally working in the background to gauge baseline knowledge and abilities. This diagnostic phase directly informs the system about how much of material a learner already knows, and can help to prevent redundant instruction or help to identify any gaps in prerequisite knowledge that may impact future learning. On the basis of this evaluation, a customized learning path is produced that meets student's needs and that leads to specific learning goals. The adaptive engine dynamically recalibrates as learners progress along their personalized paths; leveraging performance data to refine and sharpen targeting and mastery. If a student shows that he or she understands a concept faster than the rest of the class, then the system may speed up; bypass redundant practice exercises; or introduce more advanced material to keep the student’s interest and encourage better learning. When a learner is weak in certain topics, the system can also teach at a slower pace, give more explanations using different instruction strategies, offer extra examples or show preparatory materials which were not fully understood. This flexible variety guarantees that students are always studying in their range of proximal development: learning material that is tough enough to lead to growth but not so difficult as to become overloaded and give up.

Modern adaptive learning systems go well beyond basic branching logic. Early adaptive were rule-based systems with predefined paths, yet modern ones are using machine learning algorithms capable of generalizing over thousands or millions of learner interactions. If these systems can have some understanding of what kind of learners will tend to do better with visual explanations versus verbal descriptions, which students are more inclined to learn from worked examples relative to those who require discovery-based learning activities, and what kinds of misconceptions respond more or less beneficially to certain instructional interventions. Through an analysis of successful learning strategies across populations, adaptive systems are growing in their ability to connect better instructional decisions with the characteristics of individual learners.

Implementation in Educational Settings

The realization of adaptive learning in educational scenarios depends on many factors such as the kind of learning environment, content, pedagogical aim and so forth. Adaptive learning environments have been successful at the college level, especially in high-enrollment introductory-level courses, e.g. introductory mathematics, science, or statistics with a wide range of student backgrounds.(Gauthier et al., 2015). With such platforms, the teacher can manage a multilingual class set and provide each student with an adequate help and challenge. This allows professors to track classwide analytics to find out what difficulties are most common among their students, while students receive personalized instruction that is tailored specifically for their needs. In the K-12, adaptive learning systems play numerous roles. They could be used as instructional materials, practice tools or intervention resources. In the younger grades, elementary mathematics programs will frequently use adaptive technology so that students develop a number sense and computational fluency according to what they are capable of doing. Reading programs adjust to student reading levels, offering texts with the right amount of complexity and then increasing rigor as students grow. Adaptive systems are particularly useful in accommodating the diversity of students found in most classrooms, as standardization is used to differentiate instruction by teachers more similarly than could be done through manual means alone.

Adaptive learning systems are also being adopted in corporate training and professional development, where they can be used to provide efficient instruction at a high quality for adult learners with different backgrounds and prior knowledge. Adaptive models are also used in HR for compliance training, technical skills development and onboarding so employees spend their time learning the things they don't already know. The cost advantages become especially clear in business situations: corporate training is an immediate, tangible expense and employees are penny-pinching when it comes to requirements whenever possible.

Advantages of Adaptive Learning

A review of the adaptive learning literature has revealed a host of benefits associated with adaptive learning for learners, instructors and teaching assistants. Adaptive learning students generally experience higher efficiency in learning as they require on average less time to reach the objectives than when learning with traditional instruction or even increasing their mastery.

It is this boost that happens when adaptive technology takes away the redundant instruction in areas already mastered and provides a more intense focus precisely what is needed. The form of support that adaptive learning provides as a function of individual differences generally leads to higher student engagement and motivation, with students experiencing instruction that is personally relevant and at the right degree of difficulty for them. This constant feedback allows learners to profit from adaptive systems, since they can make the learning process more transparent and goal-oriented. Students get timely feedback on where they are doing well and where they need to work harder. This is helpful in promoting metacognitive skills, and self-regulated learning strategies as they begin to monitor their understanding and seek assistance when needed. Lowered anxiety around failing in a personal, adaptive setting also promotes risk and exploration key to deep learning.

Although for teachers, the adaptive learning systems offer a wealth of student learning data through robust analytics dashboards. Teachers can also see which concepts are stumping the class as a whole and which individual students need a hand, and monitor how long it takes students to complete specific activities overall. This evidence-based instruction method will also assist teachers in making knowledge-based pedagogical decisions and using instructional time efficiently. Instead of using class time for information delivery that can be tailored through adaptive systems, instructors can free up time in class to engage in activities requiring higher level thinking such as problem solving, facilitated discussion and application of learning in complex circumstances.

Challenges and Considerations

It is necessary to come clean, however, about the implementation challenges and constraints of adaptive learning. High-quality adaptive learning systems are expensive to build; in technology terms, they are content-intensive, algorithm-heavy and platform-rich. And content experts need to collaborate closely with instructional designers, data scientists and software developers in order to build systems that are not just sound pedagogically, but technically as well. Concluding remarks it should be noted that the development of adaptive systems is costly and complex, so they are most suitable for courses with significant numbers of learners since cost-effectiveness will be achieved. Issues around privacy and algorithms are also important ethical implications for adaptive learning. The systems capture a rich set of data about patterns of student learning, cognition and performance, with implications for data security and usage. Educators and providers should safeguard student data to make sure it is used only for academic purposes. Furthermore, the algorithms that underlie adaptive systems can be opaque, or difficult for teachers and learners to understand: They may not know exactly how content and pacing decisions are generated. Without transparency, there could be questions of fairness and whether the systems reinforce biases already present in training data.

The quality of the adaptive learning model is only as good as the instructional design and content it is built on. A system that is adaptive on weak pedagogic content, or faulty assumptions of how to learn, will not be more educational in the long-run just because it personalizes how you see it. There is a risk that the technological savoir faire of adaptive approaches masks basic instructional quality problems. And adaptive learning is most effective with clearly defined objectives and structured content, making it less appropriate when we want to nurture creativity, critical thinking and similar higher-level mental criteria, which call for a more open-ended process of exploration.

The Future of Adaptive Learning

The Next chapter in adaptive learning The next iteration of adaptive learning is likely to be even more personal, and it will have to be developed as a part of other educational technologies. Improvements in artificial intelligence, natural language processing, and affective computing will support adaptive systems, which can adapt to both cognitive as well as emotional states and attentional and motivational constructs. The systems are starting to integrate sensing of frustration, boredom or confusion and adapt with perhaps encouragement, instructional variation or suggesting you take a break. Personalized learning ecosystems Adaptive learning will supplement and be packaged with virtual reality, Collaborative Learning Platforms and Authentic Assessment Tools to give rise to deeply personalized learning ecosystems. Rather than isolated platforms that can offer knowledge in its pure state, these advanced adaptive systems will act as coordinators for a variety of learning experiences, modulating the content not just what content to provide but by what kinds of learning activities best suit each student at particular stages their own development. The vision is toward lifelong learning systems that scaffold individuals across their lifetime and career, maintaining a learner profile for instruction from early childhood to the world of active employment.

3.2.6 Gamification: Motivation through Game Elements

The Foundations of Gamification in Education

In the educational context, gamification is defined as “the use of game design elements in non-game contexts” with the specific purpose of motivating and engaging students in order to promote their participation in learning activities (Deterding et al., 2011). This motivation is inspired by games, which are widely acknowledged, and described in detail later, to be a powerful motivator of voluntary long-term cognitive engagement. Gamification is integrating aspects of points, badges, leaderboards, levels, challenges, narrative and reward into an educational system in order to take advantage of the psychological mechanisms that make games so appealing by taking these components and applying them to learning processes.

The theories behind gamification come from a number of areas, such as behaviorist psychology, motivational theory and game design. Self-determination theory, which outlines autonomy, competence and relatedness as intrinsic psychological needs, offers a lens to explain why game elements can prompt motivation. Good gamification affords learners the ability to make choices and have control (autonomy), it offers recognizable feedback about performance and success (competence) and allows for social interaction and collaboration experiences (relatedness). Flow theory is also relevant to gamification design since games are brilliantly good at tuning the optimal challenge levels that ensure engagement of the recipients balancing skill and difficulty level, thus keeping players in a state of focused immersion.

Differentiating between extrinsic and intrinsic motivation is a key factor in successful gamification. Extrinsic rewards, such as points and badges in games are motivating but the point of well-designed gamification is to augment (and not replace) intrinsic motivation. Done badly, gamifications can demotivate by giving all power of engagement external; in other words through extrinsic motivation (over justification effect). Successful gamification applications effectively use the extrinsic to scaffold engagement and learning, but build toward intrinsically motivated interest in learning content and development of mastery.

Core Game Elements and Mechanics

Gamification's arsenal contains many features that be reformatted for educational. Point based incentivisation gives learners instant feedback and a feeling of progression, motivating them to achieve goals or levels by fulfilling different tasks: performing an activity, showing knowledge or doing what is expected. Points may be transparent, revealing to learners exactly what earns them rewards, or points might include an element of discovery as our learners try to figure out how they earn them. The evidence of effort and accomplishment is accumulated in the form of points which can have a positive effect on how confident your players feel about what they know ("competence feedback").

Badges are symbolic rewards that acknowledge accomplishments, milestones or documented capabilities. Badges, unlike points, are qualitatively articulated in the kinds of statements they make about what learners have done. An award for doing challenging problem sets means something quite different from an award for helping classmates, and by doing so the reward system would reinforce a wider range of desirable behaviors. Badges are signs of success that you can also show off to others, which fulfil social desires associated with being recognized and having status. Aggregations of badges tell a story, or the narrative arc over time about what the learner has accomplished. They encourage competition through leaderboards, which show where you or someone else stands in terms of points earned, achievements unlocked or what have you. Leaderboards may work very well for certain learners who are competitive and doing very well, but also demotivate others as they always find themselves at the bottom of the rankings. Nuanced solutions address this by creating multiple leaderboards across dimensions or by using relative ranks that compare learners with like peers rather than whole populations, instead emphasizing improvement and effort not absolute performance. Pseudonymous leader boards, ie, ones that show only top performers and the individual's own rank provide motivation but can help reduce adverse social comparison effects. Stages and stages establish clear structure and progression for learning, allowing individuals to feel they are making progress. Learners unlock the subsequent level as they fulfill requirements in one gaining a feeling of forward movement. Leveling also can create a nice ramp up of difficulty and complexity insisting that they remain in their challenge zone. With the promise of playing on the next level and patting yourself on your own back after completing one, motivational cycles are created that keep people interested for long lengths.

Based on estimates, SGS is the first technology-supported educational system in which challenges and tasks are represented as missions or adventures with contexts and aims. Instead of working through problem sets, students might work on a mystery or try to save a virtual world or complete some goal that has personal significance. This story-based scaffold can ground abstract academic knowledge in meaningful terms. Challenges can be collaborative or individual, timed or untimed, and may involve other elements such as obstacle to overcome, resources to gather and maybe rewards upon completion.

Implementation Strategies and Pedagogical Integration

Education gamification that works integrates well with teaching goals and learning aims. Game elements should be complimentary and not detract from the learning with mechanics that complement educational intentions. In a language-learning app, for instance, points can be earned by repeated practice of vocabulary, following through to the completion of conversations or keeping learning streaks on a day-to-day basis and each mechanic would reinforce certain behaviors related to language acquisition. The design of the game should more than hint at what "success" is and yet it will remain challenging to achieve, encouraging skill growth. Gamification may be implemented at different levels such as tasks, courses, or curriculum. On the assignment side, a teacher could gamify a project with points systems, earning badges and challenge modes. At the class level, gamification could become an integrative approach that informs how the whole semester-long learning experience will be organized as if students were going through levels and gaining access to new content of some kind or checking off achievements along the way. Some schools and academic programs have taken gamification to the next level and constructed ambitious reward systems that span courses, semesters or even years.

The collaborative and social aspects are strong components of educational gamification. With challenge based teamwork, opportunities for peer learning and social interaction are enabled simultaneously, and the pressure of competition is spread across group members. The use of cooperative game mechanics, where involvement and collaboration is necessary for players to solve problems or meet objectives as a team, may work very well as a community-building and collaborative skill development scaffold. Some social functions such as sharing achievements, assisting other learners, or engaging in friendly competition can raise motivational scaffolding and enhance the relatedness dimension of self-determination theory.

Feedback Systems in Gamified Learning Environments provide learner feedback based on his/her behaviors and actions, aiding enhanced learning. Relationship The great difference in time between traditional education, where the feedback can take days or weeks, and gamified systems that allow us to know quickly how well we are doing is remarkable. This immediacy encourages students to relate their behavior with the outcomes, what eases learning and helps in keeping them motivated. The feedback needs to be supportive and substantive, helping learners understand not simply that they got things right or wrong but how and why, as well as what they might do differently next time.

Benefits and Research Evidence

Research on gamification in education has produced some mixed but largely positive results, which depend heavily upon the quality of implementation and on the context. Carefully implemented gamification that increases engagement (quantified by effort, voluntary participation and persistence in the face of challenges) has been found to enhance active learning. Learners participating in a gamified educational environment generally claim the type of content to enjoy and be interested in has increased when taking into account even the most boring or difficult topics. Studies of learning outcomes have shown that gamification can improve performance, especially among groups of students already performing at lower levels but who would benefit most from greater motivation and engagement. Instant feedback and explicit structure gamified systems offer weaker learners can help them finish the tasks, understand what is expected for such tasks and check their results in a better way. The various routes to victory in most gamified systems provide different types of learners with an opportunity to find something that works for their unique abilities and tastes.

The motivational effect of gamification on behaviors such as attendance, assignment completion and participation in optional learning activities. The reinforcement principle provided by game elements may help to reduce the feeling of weight and burden of educational tasks while making learning activities more intrinsically rewarding. When game mechanics provide reinforcement for such behaviors, students may be less averse to tackling difficult problems which they are not likely to solve on the first try, taking academic risks and enduring through tough learning. The illusion of progress granted by levels and achievement systems can incite us to stick with long-run goals that we otherwise would find boring, arduous or just beyond our capacity. The social learning advantages manifest when there is a balance of collaborative and competitive aspects in the design of gamification. Identified game activities, like talking about class content and forming study groups and helping others as they level up may promote these behaviors in the real world with classmates. Learning alongside together following a gamified course can lead to a sensation of community and shared purpose among learners. When successes are socially recognized, they may serve to validate the effort and skills of learners and satisfy the psychological 'cocktail' that can support the development of learning cultures.

Challenges, Criticisms, and Best Practices

Yet, while gamification holds the promise for potential benefits, it is not without valid criticisms and implementation hurdles. To these adds the concern for whether or not game elements could detract learning goals, if stimulating participation would be enough to reach understanding. Material can be "gamed" where the focus is on accumulating points or badges, rather than depth of interaction; a movement some call gaming the system. Superficial implementations which bolt on points and badges to the instruction without a clear vision of the pedagogical need are going to result in very little advantage, if any. The potential for undermining intrinsic motivation is a significant concern in gamification. If extrinsic rewards become the focus of engagement in learning activities, students can disengage from the curricular content. This is especially undesirable when rewards are withdrawn and can even result in lower engagement than before gamification. Scaffolding solutions to this have been to make sure game elements don't replace intrinsic motivation, but support it and also incorporating rewards as feedback or structuring rather than a "reason" people participate.

Different individuals respond differently to gamification and a motivating system for one student can be demotivating for another. Grouped elements are nice for people who like competition and feel like they can be successful, but it feels bad to always do poorly in rankings. Some matriculants dig badge collects and achievement systems; others think they are silly or babyish. Cultural differences are also considered may cause different gaming effects, for instance collectivist culture and individualist culture will probably react in a different way from particular game features such as individual competition. Optimal design approaches for the educational gamification include matching game mechanics and academic goals, optimal ratio of extrinsic to intrinsic rewards, and support for diverse ways to win. Good gamification is also

Optional or has ways you opt out for students who aren't interested in the game aspects. Experience with these students has taught me to design against outcomes in which success is never attainable for these students or where the game's mechanics encourage sustained, unhealthy time investment. Being transparent about both how game systems function and why they are being used allows students to understand the pedagogical rationale of gamification, instead of feeling like they are being manipulated (Werbach & Hunter, 2012).

Emerging Trends and Future Directions

The next generation of educational gamification is moving toward complex, individualized, and contextually embedded learning environments. AI provides capabilities to support adaptive gamification, makes the challenges, rewards and game elements evolve according to learner's interaction and preferences. Instead of one-size-fits-all point systems, the next generation could use game-based experiences that reflect each learner's motivation profiles, learning styles and progress statuses. These gamified learning experiences will be even more engaging once they are plugged into immersive technologies like VR and AR. Instead of game-like point systems imposed on top of conventional instruction, students could live in game worlds that make learning activities an organic part of game narratives and procedures. The design of enduring learner profiles across courses and learning experiences may lead to more robust long term engagement systems. So instead of gearing up from scratch for each course, a learner can capitalize on past successes, continue with a reputation and record to maintain, and aim over multiple years. These would have to balance continuity with new beginnings, preventing early difficulties from forever disadvantaging learners.

3.2.7 Flipped Classroom: Inverted Teaching Models

Conceptual Foundations of the Flipped Classroom

The flipped classroom is a pedagogical model in which the typical lecture and homework elements of a course are reversed; students learn basic content material at home, often through online video or audio lectures, and then attend class to work with classmates on problem sets or projects. Traditional classrooms involve a vehicle by which teachers introduce new information during class time (lecture or demonstration format), while students attend to application activities (e.g., problem sets, essays, and projects) on their own at home. The flipped model flips this process, with students introduced to new material prior to class through videos or readings, for example and class time used for discussion, group problem-solving, interactive work and direct assistance from instructors. The theoretical basis of flipped classrooms is based on constructivist learning theory which highlights active learning for knowledge construction. Learners do this when they are being lectured at and have few (if any) chances to articulate, question, and assimilate new information with their prior knowledge. Offloading content delivery away from class, flip frees precious face-to-face time for deeper learning activities that involve the transfer of ideas to new contexts, analysis of more complex problems, synthesis (or integration) information presented in various sources and metacognitive reflection. So there is the added advantage that during this more cognitively challenging work, teachers are right there when children most need that support and assistance.

Another limitation of traditional teaching is that during lectures all students need to follow the same pace, irrespective of their individual level and profile. This issue is overcome by using the flipped classroom approach. In a flipped classroom, they can interact with content delivering material on their own time, pausing videos to take notes or reviewing confusing explanations and work more thoroughly through difficult concepts. This independent learning facilitates differentiation that is challenging when teaching in a traditional whole-group format. For students who understand their materials very quickly, they can go through material more efficiently; for those who need the opportunity to revisit things over time and see them multiple times, it can help with flexibility.

Implementation Models and Variations

The operationalisation and practical aspect of flipped classroom models differ widely at different educational levels, disciplines, and in line with instructor preference. Most frequently, this model entails instructors making or finding video lectures for students to watch before class (usually via learning management systems or video platforms). These videos could include faculty-produced mini-lectures, explanations of difficult concepts or procedures, demonstrations, exhibits from resource materials. Pre-class videos are usually 5-15 minutes in length and serve to break content into manageable units, keeping shorter attention spans active and allowing for focused learning sessions. In addition to video-based content delivery, flipped learning environments can use a variety of media and activities for out-of-classroom instruction. Students can do textbook reading or articles, online modules or simulations, podcasts, virtual environments and discussions, even solve completed problem sets that teaches concepts. The underlying principle being that students are presented with foundational material at home to enable active participation in class. Assessment activities such as pre-lecture reading quizzes or online homework motivate students to do the required pre-class work and provide the instructor with information about student understanding before class starts.

In flipped classes, the in-class element focuses on active engagement with content to make learning deeper. Instead of delivering lectures, teachers drive discussions, direct problem solving, lead hands-on labs or projects, assign group work and offer personalized feedback and assistance. Class is a workshop, and students work at learning to apply ideas or struggle to solve hard problems while working alongside peers and getting guidance from experts as things develop. The teacher becomes less of a source of information to students and, instead takes on the position as learning facilitator, coach and mentor who can see student thinking and act intervening with specific support. There are also different forms of the flipped model, for example, in the micro-flipped classroom design where part of class time is flipped rather than entire courses, so that faculty can test it out or only use flipping with content that lends itself to being taught using such an approach. Peer instruction involves a flipped classroom style and structured interactions in which students discuss and argue over conceptual questions with their peers before the instructor delivers an explanation. This mastery-based FL environment combines adaptive learning and competency-based advancement, meaning that students need to understand what they are watching before proceeding with other material. There variations illustrate the flexibility of the flipped model and how it can be applied to a wide variety of educational environments.

Benefits and Learning Outcomes

Many studies have already been conducted on the outcomes of flipped classrooms. Students in flipped classrooms generally perform better academically, especially when they are tested on application, analysis and synthesis of information rather than memorization. Ultimately, more time is available to students for active learning and for the application of concepts in class. The ability to get help solving difficult application problems instead of giving up or making errors at home (which may contribute to misconceptions) promotes learning in a way that is especially important for students whose reactions are likely to be defeatist. Student engagement is enhanced in a well-run flipped classroom and reports demonstrate greater interest, motivation, and satisfaction on surveys than in traditional classes. In flipped class sessions, the interactional aspect of learning is perceived as more dynamic and meaningful. Students value the ability to absorb theoretical information on their own time and work with an expert in class, rather than having passive exposure to a lecture. The meet-and-confer atmosphere of flipped classrooms can help build peer relationships and more supportive learning communities.

The flipped method gives teachers more chance to avoid lecturing at classes. Instead of giving identical lectures, instructors get to see people work problems and can assist in ways that directly address actual student needs. This diagnosting teaching facilitates increasingly responsive, adaptive teaching to the particular difficulties students are having. “Flipping” of classrooms is also known to spark higher satisfaction levels among teachers, who are feeling more effective in leveraging their expertise and engaging with students. It can also be suggested that the flipped classroom model may support equity, providing all learners with a high quality of content delivery even when external constraints might limit their ability to gain from traditional lectures. Absendee, distracted or slow at catching up traditional lecture students can watch the same recording several times. English learners can turn on subtitles or translations and proceed at an unhurried pace to process explanations. Students with learning disabilities can employ assistive tech and work at the pace that suits them best. The model's adaptability accommodates the full spectrum of learners in ways that regular instruction would not be able to do.

Challenges and Implementation Considerations

However, in spite of the proven advantages, flipped classroom integration encounters many challenges. The up-front time commitment of producing or choosing high quality pre-class materials may be significant, especially for instructors new to creating video content. Recording lectures, editing videos, designing ancillary materials and adapting suitable in-class activities takes a lot of time on the front end but significantly less each subsequent offering. The technical expertise that goes into video production may be daunting for largely non-tech-savvy faculty, but institutional support and training can help to minimize this obstacle. Resistance from students to the flipped model is another major obstacle. Faced with etiquette-based vs. evidence-based instruction some students who have come to education after years of traditional pedagogy might experience up-fronting the learning as an add-on rather than a substitute for traditional instruction. Other students gravitate more toward the routine and passive dynamics inherent in traditional lectures, feeling somewhat uncomfortable or stressed by the greater responsibility and active engagement that a flipped environment demands. Cohere (2014) suggests that the resistance we may experience is a reflection of poor communication regarding why flipping is being implemented, as well as insufficient support to enable students to acclimatize to it.

Motivating students to engage in pre-class activities such as reading and watching lectures is a thorny issue for flipped classrooms. Many students, for example, would come to class unprepared if there were no accountability mechanisms, and the whole model could fall apart. Educators usually counter this issue by providing low-stakes quizzes, participation grades, or other motivational devices to lecture attendees to engage with pre-class work. Nevertheless, such accountability does not come without contradiction with regard to generating compliance-orientated motivation above and beyond a truly meaningful engagement with the content. Technology access and dependable internet can be a matter of equity in flipped classrooms. The problem is that for those without reliable computer equipment and internet at home, students can run into obstacles in completing pre-class work, making them disadvantaged when compared to their more fortunate classmates. Schools using flipped models should facilitate the acquisition of necessary technology for all students, through such means as equipment loaner programs, extended-hour computer labs, or access to materials in other formats. The assumption that all students have easy access to video viewing or online materials out of class needs careful testing and buttressing.

There's tons of variation in the quality of flipped instruction. Just videotaping old lectures and setting them for homework without much in the way of carefully planned activities seems unlikely to confer maximum advantage on this model. For successful flipping, a question must be given to what is best for self-study, how we should structure of pre-class materials for learning, as well as to the design of optimal forms of face-to-face activities that respond to and enhance subsequent independent learning. Weak execution that still has learners passively engaging during lessons falls far short of the mark in terms of flipping.

Best Practices and Design Principles

There are certain principles and best practices that flipped learning design should observe for proper implementation. Preliminary class material should be tailored to the independent study type and not just copying traditional lectures. Videos should be brief, centered on a precise concept or skill and offered strategies to keep things interesting such as embedded questions, examples, or visual enhancements. Giving students learning objectives, guiding questions, and note-taking templates help them interact with content as opposed to sitting passively when they watch videos. Activities that take place in class should focus on higher order cognitive skills and collaborative learning. Instead of covering pre-class material via the mini-lecture, instructors should start with application exercises or problems or discussion or other active techniques immediately. The design should cause "cognitive dissonance" or productive struggle that engages the students in wrestling with hard ideas through peer and teacher support. Tasks should be designed to show students thinking in order that teachers can recognize and correct mistakes on-the-spot. Establishing a visible link between what students do before class and during class makes the role of independent study more apparent to them, thereby encouraging their interest in the materials. The in-class assignments should flow directly from the pre-class materials and create a clear sense that those who have prepared do better. Starting class with some short activities that permit students to discuss or try their hand at pre-class content serve several purposes: the activation of prior knowledge, the illustration of the value in preparation, even allowing those who missed a particular concept in a previous session to catch up by hearing how peers have approached similar questions.

Frequent student evaluations of whether they "get it" or not ahead of and during class can help you make instructional changes. Pre-class quizzes or homework questions outline the content that needs to be addressed more fully, which can inform what information should be covered in class. Classroom based techniques like think-pair-share, concept questions, and exit tickets give immediate feedback about learning and assist instructors in real-time appraisal of whether students are meeting learning outcomes. This formative feedback model allows for responsive teaching and dealing with concrete student problems.

Next Evolution of the Flipped Model

The model of the flipped classroom has been changing due to the maturing of ICT technologies and teaching philosophy. Integrating with adaptive learning platforms enables higher levels of personalization in pre-class work, where students can be assigned readings and exercises that are more finely targeted to their knowledge level and learning requirements. Adaptive instruction is tailored to individual students' characteristics, learning needs, and performance). Unlike a one-size-fits-all approach where all students view the same video, adaptive systems can offer different explanations, examples or practice questions for each student. Experiential learning by integration of interactive elements in pre-class assignments Lessons are brought to life with experiential learning by integrating interactivity into pre-class assignments. Students would not just be watching passively but perhaps actively interacting with a simulation, completing in-video practice problems and getting immediate feedback, going on virtual labs or exploring annotated resources with mulmiple media types. These engaging formats change the way students prepare for class, so that passive pre-class 'consumption' is turned into active pre-class preparation, maximizing student-teacher contact time during class. A learning model that is gaining popularity is the flipped approach, often used as a part of other transformative pedagogical methods like project based learning, inquiry-based learning and authentic assessment. Instead of just using textbook formulations for problems during class, students could deal with real-world projects that require knowledge and skills to be applied over time. The flipped model itself encourages and allows this extension with its flexible removal of time spent on content delivery in class.

3.2.8 Future Trends: Virtual Reality, Augmented Reality, Metaverse in Education

Virtual Reality: Immersive Learning Environments

Virtual reality (VR) technology is set to revolutionize the educational experience by enabling environments where learning occurs that are truly immersive in which users can search, play and sense phenomena as if it were not possible, feasible or safe in real life. VR employs head-mounted displays and motion tracking to construct realistic-seeming but illusory feelings of physical presence in 3D virtual environments, enabling users to experience objects and spaces as if they were real while navigating through them and interacting with them in naturalistic ways. The applications for this kind of technology are nearly limitless across the educational spectrum, from examining molecular structures in chemistry or touring historical sites in social studies to practicing surgical procedures in medical schools and even admiring art in 3D.

The educational potential of virtual reality stems from the fact that it makes possible experiential learning our senses can be engaged in and embodied. Instead of having to read about or view 2-d representations of these concepts, students can experience the phenomenon themselves and develop spatial sense and intuitive understanding only achieved with conventional media. The immersion presented in VR means learning becomes more memorable and fact-based, as studies have proven people retain information learned while completely immersed higher than that obtained from traditional methods. Virtual experiences that resonate emotionally can lead to impactful learning moments that encourage further discovery and ongoing attention. Educational VR experiences vary from being passive 360-degree video (Lucey et al., 2015), to complex active simulations with realistic physics engines and adaptive prompting systems. Immersive field trips enable students to experience coral reefs, ancient civilizations and more without ever leaving the classroom. Science simulations allow students to manipulate variables and view the results when experiments would be too costly, time-consuming, or dangerous in actual laboratories. Simulation-based medical and vocational training offers 'safe' environments for trainees to develop proficiencies through repeated practice and real-time feedback. Reenactment can also help students experience key historical moments, daily life from a range of periods or look at primary sources in context.

Augmented Reality: Blending the Physical and Digital Worlds

Meanwhile, augmented reality offers a different but similar concept for immersive education by adding digital information and virtual objects to the physical world rather than completely transferring it. With AR technology, which can be experienced by holding a smartphone or a tablet over the image of CNN on paper or screen as well as through dedicated glasses, additional computer-generated content appears in already real-world view – this way users have truly mixed reality experience where actual physical space is not replaced but rather enriched by digitally integrated content. This approach provides novel educational opportunities, especially for education which needs to connect with physical space/objects or actual environment.

Educational AR apps let students see the abstract in the tangible, physical world. In mathematics, students can have three-dimensional geometric objects pop onto their desks that they move around to learn about properties and relationships. In anatomy lessons, AR can project internal organs on top of physical models or even students' own bodies, helping them comprehend the three-dimensional relationships among the human body's parts. Students of chemistry will be able to see molecular structure and reactivity in space, developing an intuitive feel for bonding, conformation and reactivity. The combination of AR and physical environment presents tremendous possibilities for contextual learning. Traditional AR apps can offer historical depictions or information placed on top of current settings, letting students see how places have transformed while visualizing. AR- enhanced museum displays offer extended description, interactivity,… and support of multiple languages, therefore enriching visitor experience. AR tools help science fieldwork by identifying plants, animals, geological features or astronomical objects and offering educational content on the spot in authenticity (Välimaa-Blum & Saari 2017).

Collaborative AR experiences allow multiple learners to see and interact with the same digital content that is placed onto their shared physical world, thus encouraging collaborative learning as well as social construction of knowledge. Students could collaborate to build a virtual machine, run a virtual experiment or solve a spatial puzzle where all individuals can interact with and modify the shared objects. This collaboration aspect of AR-based learning fits in nicely with constructivist pedagogies of the need for people to work together and talk to one another if they are to build understanding.

The educational metaverse: A new wave of virtual learning worlds

The metaverse, interconnected decentralized or centralized virtual worlds where users can meet, socialize, integrate their data and in some cases even build and inhabit physical structures together, is a new terrain for education. Although current metaverse implementations are still in early development, the vision involves a wide-ranging virtual learning environment that continues over time where students can take classes, work on projects, connect to resources,

socialize with peers and engage in learning activities through coherent digital spaces. Instead of standalone VR experiences targeting specific learning outcomes, the educational metaverse refers to entire virtual campuses or learning worlds that offer fully fledged educational experiences. Virtual educational metaverse platforms could take such a form by re-creating campuses in the virtual world, enabling remote students to partake in courses, attend virtual office hours, study in the "library" and engage with campus life despite their geographical location. This method could widen access to education for individuals unable to attend traditional educational institutions because of location, disability, lack of money or other reasons. The metaverse would also enable completely new types of learning spaces that would be impossible in the physical world, constructing, for example, campuses that break the laws of physics or spaces that can reconfigure themselves dynamically in response to learning activity, or simply areas where resources from multiple institutions and organizations all coexist seamlessly.

And because these metaverse spaces are persistent, there is potential for collaborative learning initiatives to span weeks, months or more. Students might collaborate to build virtual museums, develop sustainable virtual cities, produce pieces of art, or engage in long-term scientific experimentation inside metaverse locations. Allowing users to save and re-open works-in-progress, along with creation and collaboration tools help support constructionist models in which learners engaged in such making/ sharing live by building knowledge through creating artifacts. Social learning is an essential aspect of the types of educational metaverse visions. In this virtual community, students could chat with their fellow classmates or teachers - or even industry professionals - through avatars to study together, attend a lecture, or just to socialize. The metaverse would enable learners from around the world to meet each other and follow a course together, forming international learning groups and developing intercultural dialogue. The social experiences resulting from this sort of informal learning are often just as transformative as the formal training, and in the metaverse these kinds of serendipitous encounters or impromptu collaborations have a place.

Technical Infrastructure and Implementation Challenges

Cheaper by the Millions (of headgear) the deployment of technologies for immersive education at scale raises a number of technical and infrastructure challenges. VR() and AR(*) need complicated hardware such as head mounted displays, high performance PCs or mobiles, guaranteed high speed remote control networks (for VR), and sometime specialized sensors/controllers. The expense of these tools is a limiting factor for classrooms, especially in underfunded settings. Prices are dropping and mobile-based solutions provide more affordable entry but making available immersive technologies in an equitable manner remains a challenge. The creation of high-quality educational VR and AR content therefore necessitates involvement from multidisciplinary teams, comprising educators, instructional designers, 3D artists, programmers and user experience experts. Making realistic and believable virtual worlds that have good physics, interactivity and pedagogically sound design requires hefty amount of time and investment. The skills set required to develop immersive content is not well distributed and many teachers are either untrained in the development or use of immersive technologies. Capacity building through professional development and developing tools to allow educators to create content without needing strong technical skills, are necessary for scaling immersive education.

User experience issues may involve motion sickness in VR, desktop clutter, information and stimuli overload or excessive push from the interface (or other) and accessibility problems for people with disabilities. Long-term use of VR can be uncomfortable for many users, with session lengths restricted and some learners being effectively excluded. Developing experiences which cut through these problems to enable the richest possible learning is a matter of human factors and rigorous user testing. Accessibility requires that immersive learning experiences be able to address the diversity economic (such as those with visual, auditory, motor and cognitive disabilities) may have. Technical short-fallings of today's VR and AR systems include limited field of view, resolution limitations, tracking inaccuracies, computational bottlenecks mainly restricting complexity and realism of virtual environments.

Burgeoning advances in technology notwithstanding, existing systems are not yet capable of delivering such seamless, photorealistic virtual worlds as one often associates with talk about immersive education. Keeping up with the promise, what is possible under current technical constraints is a matter of striking the right balance between grand visions and pragmatic implementations.

Pedagogical Considerations and Learning Design

Meaningful utilization of these new immersive technologies for learning require careful pedagogical design that builds on the distinctive features of these media while remaining rooted in the evidence-based theories of learning. VR and AR are not necessarily better than other educational media; its usefulness relies on the fit between technology affordances and learning goals. Here, immersive technologies are ideally placed for spatial learning, procedural skill acquisition, experiential understanding and occasions in which learners simply need to physically be within environments that would otherwise be unreachable. They might not be as suitable for content which does not make use of spatial or immersive representation. In VR and AR, the learning experience should revolve around active engagement and NOT be focused on passive consumption. There is little to be learned from simply observing 360-degree video or wandering around in a virtual environment if the experience does not involve some kind of interaction, problem-solving or application of knowledge. Good immersive learning designs have problems, support structures, feedback loops and reflection points that all support processing and comprehension. The immersive experience should support and not detract from learning goals.

In order to effectively integrate immersive experiences with larger curricular constructs, educators need ways to think about how VR and AR activities articulate with pre-and post-activities in the physical space or within online platforms. Pre-immersion preparation facilitates learners' understanding of what to look for and how to interpret experiences. It is through reflection and discussion after immersion experiences that learning can be cemented and experiential learning connected to conceptual models.

Immersive practice is most effective as part of an integrated learning package rather than as isolated interventions.

Opportunities and challenges in assessment of immersive learning environments. VR and AR platforms are able to record granular information about learners' behavior, decisions and interactions; enabling us to observe cognitive processes and skill acquisition in ways difficult to achieve using other methods. This information will be used to provide formative feedback and adaptive instruction. Yet assessment in the space is something that needs to have its validity and reliability tested, and questions remain about data privacy and surveillance. Research on identifying which dimensions of immersive performance correlate with significant learning is ongoing.

Research Evidence and Learning Outcomes

There has been a surge in research regarding learning outcomes within immersive educational contexts in the last few years, with predominantly positive but moderated results. Meta-analyses suggest a beneficial effect of VR and AR on learning as opposed to methodologies without, effects vary depending on the topic area, the quality of implementation and the outcome measured. The advantages seem greatest for spatial knowledge, procedural abilities and memory of information learned through experience. For learners who have difficulty understanding abstraction or who learn best through visual-spatial representations, immersive technologies hold particular potential. Engagement and motivation are enhanced through immersive technologies with students generally expressing more interest and enjoyment in learning activities. This may be corroborated by the novelty of VR and AR innovations such as motivation that wears off over time, although some studies indicate positive motivational effects even after novelty has faded if experiences are well designed and deeply integrated within learning (Huang et al., 2010). It seems that the feeling of presence, and the possibility for natural interaction with virtual objects help maintaining engagement beyond straightforward novelty. The issue of learning transfer from virtual to real-world environments is highly relevant in applied fields e.g. medical education, vocational training or safety training. Skills taught in high-fidelity simulations can be transferred

to real performance, especially when simulator experiences are closely modeled on actual settings and training includes variation to support transfer. Yet, transfer is not self-evident and its extent depends on how well virtual conditions match with real situations and tasks. Responses to immersive learning environments vary depending on individual differences. Students with high spatial ability may derive greater gains from VR experiences focused on spatial content, and students with low spatial ability might need more scaffolding. Digital literacy and gaming experience could influence comfort and success when navigating XR environments for the first time. Age, sex, and cultural influences may also determine the user’s responses to immersive technologies, and therefore should be carefully considered in the design and deployment of these tools.

Ethical, Social, and Privacy Considerations

The introduction of immersive technology in education has raised key ethical concerns that will need to be addressed as the technology is implemented on a larger scale. Data protection is a key issue, since VR and AR devices can track extensive user data on movement, gaze direction and types of movements as well as physiological reactions. This information is much richer and possibly more invasive than data captured using standard educational technologies, and questions of collection, storage and use are raised. Strong safeguards and clear policies are necessary to make sure student data is not misused. The ability of immersive technologies to bias people is one other ethical issue. Assumptions and biases from such creators can be translated in elements like gammification which are automatically added to the virtual world. Completely, poisoning both the public perception and historical creativity by endlessly repeating stereotypes or share very limited point of views. In historical simulations, contested interpretations may be presented as fact; virtual humans could reflect only limited demographic diversity; and virtual worlds might replicate real-world inequalities. At CMESG, we hope that being vigilant about content and diversity of representation in design teams can help with such limitations. Emotional concerns regarding immersive experiences need to be attended, especially for younger or trauma experienced learners.

Strong virtual experiences can induce real emotion, such as fear, anxiety or discomfort. Although educative responses such as these can be appropriate, they do need to include content warnings and an opt-out for those students who find it too distressing. Balancing on the line between valuable educational pain and damaging psychological harm is something that needs to be considered carefully. Social considerations are related to escalation of screen time, decrease in personal contact and possibility of addiction to immersive environments. Although immersive technologies might make possible sociality and collaboration across geographical distances, they should not substitute for face-to-face interactions (7), a fortiori for young learners who learn social skills in physical encounters. Balanced strategies which combine immersive learning with other teaching methods, carefully considering the holistic wellbeing of students, are required.

Future Trajectories and Long-Term Vision

The future development of these immersive educational technologies is likely to bring more sophisticated, affordable and well integrated learning experiences. Improvements in hardware will lead to lower weight, comfort, and higher resolutions with greater fields of view and overall more accurate tracking. And self-contained VR headsets that don’t need an external PC are also getting better and cheaper. AR glasses are getting there in terms of looking like regular eyeglasses. This step will lower the barriers to adoption and make for longer and more pleasant immersion learning sessions. AI inclusion will make immersive learning environments more intelligent and adaptive. VR intelligent tutoring systems could offer personalized directions, react to learners resulting performance and provide immediate feedback. They can be used as instructors, tutors, peers and characters in educational scenarios who have the ability to provide intelligent responses based on user actions and queries. Natural language processing will allow voice interaction with virtual worlds to be more instinctive and feasible. These immersive technologies will merge with a host of other educational innovations to form holistic personalized learning ecosystems. Adaptive learning systems might also capitalize on VR and AR by offering personalized experiential learning activities according to the leaner profile.

Elements of gamification could be incorporated as part and parcel of immersive environments, with challenges, rewards and progression mechanisms hardwired into virtual reality landscapes. The integration of multiple technology-based strategies could lead to learning experiences that are immersive, adaptive, social and engaging. Through the creative structuring of content and the use of technology beyond the classroom, these immersive technologies could become a common aspect of education if obstacles such as cost, technical difficulty, access to content, and educator training are resolved. As costs come down and as the tools accessible to non-techies become easier to use, educators will have more resources available for integrating immersive experiences into their teaching. Creation of large repositories of high quality educational VR and AR content through perhaps an open educational resources model will make this more doable. Teacher training that supports the pedagogical use of immersive technologies is required to unlock their potential.

A long-term goal for immersive education is one where the physical and virtual worlds are integrated into a seamless learning experience, where learners can bring the full range of their bodies to investigate any topic, where collaboration opens up possibilities that transcend location and time-zones, and where education becomes more equitable, inspiring, effective through precise integration of these cutting edge technologies. Achieving this vision will require ongoing work in technology development, pedagogical research, content creation, equity issues and policy. The learning benefits are huge, and studying how to address the problems we face today is an investment worth making so that as education changes to meet the opportunities demand of immersive digital spaces.

3.3 Self-Assessment Questions

3.3.1 Multiple Choice Questions (MCQs)

1. **Educational technology primarily deals with:**
   a) Administrative planning
   b) Systematic application of technology in education
   c) Student discipline
   d) Curriculum development only
2. **The main components of educational technology are:**
   a) Hardware and teachers
   b) Hardware, software, and system approach
   c) Only audiovisual aids
   d) Textbooks and blackboards
3. **The nature of educational technology is:**
   a) Fixed and limited
   b) Interdisciplinary, evolving, and practical
   c) Theoretical and abstract
   d) Unrelated to teaching practice
4. **The system approach in education involves:**
   a) Random trial and error
   b) Planning, implementation, evaluation, and feedback
   c) Rote memorization
   d) Teacher-centered control
5. **Artificial Intelligence in education helps in:**
   a) Replacing teachers
   b) Personalized and intelligent tutoring
   c) Only grading exams
   d) Reducing interaction

6. **Blended learning means:**
   a) Traditional classroom only
   b) Combination of face-to-face and online learning
   c) Fully online courses
   d) Distance learning only

7. **Cloud computing provides:**
   a) Accessibility, storage, and collaboration
   b) Offline resources only
   c) Data secrecy only
   d) Multimedia animation
8. **Learning analytics is used for:**
   a) Entertainment
   b) Data-driven insights to improve learning
   c) Manual evaluation only
   d) Blocking student data
9. **Gamification in education refers to:**
   a) Playing games during class time
   b) Using game elements to motivate learning
   c) Teaching only game design
   d) Replacing study with gaming
10. **A flipped classroom is one where:**
    a) Teachers record attendance online
    b) Students learn content at home and practice in class
    c) Students teach teachers
    d) No homework is given

3.3.2 Short Answer Questions

1. Define educational technology.
2. List the main components of educational technology.
3. What is meant by the system approach in education?
4. Mention any three emerging technologies used in modern education.
5. What is blended or hybrid learning?
6. What is gamification?

7. Explain adaptive learning briefly.

3.3.3 Long Answer Questions

1. Explain the meaning, nature, and scope of educational technology.
2. Describe the components of educational technology and their interrelationship.
3. Discuss the system approach in educational technology. What are its stages?
4. Explain any four emerging technologies and their impact on education.
5. Write a note on future trends in educational technology.

MODULE 4
COMMUNICATION AND INSTRUCTIONAL DESIGN

STRUCTURE

UNIT: 4.1 Communication Systems in Education

UNIT: 4.2 Instructional Design Models and Theories

2.0 OBJECTIVE

- Understand the concept and elements of communication systems.
- Identify different types of communication.
- Examine classroom communication models and barriers.
- Apply learning theories to instructional design.
- Understand and compare recent instructional design models.
- Develop instructional strategies based on theoretical frameworks.

4.1.1 Concept and Definition of Communication System

The participatory foundation final refers to the extent of communication, a process that is understood to be essential in the sense of Rockströmet al. A communication system, in the broadest sense, is a complex network of processes that enables: information to be imparted from a sender to a receiver; meaning to be conveyed by an interpreter between a sender and a receiver. "What is crucial to the use of the term, 'system' in this context" (Gregory & Carroll, 1978), as opposed to accidental or isolated communication if you prefer (Trubetzkoy, 1969)is that it does not present us with unity but rather "a thing constructed"(Hockett, Critical essays I. Btn: Indiana University Press). The notion of a communication system is fashioned in a broad sense from primitive gestures, and sounds to modern digital processing techniques. At its most basic form, communication is the creation and exchange of meaning by symbolic means. This definition suggests that communication is not merely sending and receiving messages from A to B but requires the complicated interrelationship of encoding, transmitting, receiving, decoding, and interpretation of communication in some context. The systemic characteristic of communication is such that all components in the system are interdependent and mutually effective, inevitably a change on one part will

affect on the whole process of communication.

Figure 4.1: Concept and Definition of Communication System

The communication system is even more important in educational context because it represents the principal channel of instruction between teacher and student. All types of methods, Such as channels or the entire set of processes through which educators communicate information and skills to learners and learners express understandings, questions, and points of view. This two-way flow of information is vital to good pedagogy because teaching is inherently a communicative process that depends on the effective distribution and reception of educational content. Various Important Dimensions of the Concept "Communication System" The concept of a communication system must have several important dimensions. For one, communication is goal-oriented: people speak and write with a specific purpose in mind, to inform, persuade, entertain or educate. Second, this is not a static event but an active process, developing as participants react and work on old messages. Third, communication is symbolical in itself and based on codes, languages, gestures and signs that mean something in certain cultural or social settings. It is fourthly transactional in the sense all partners equally become senders and receivers, continuing to influence one another throughout the turn exchange.

Whether or not you accept that communication systems exist, it is important to recognize the systemness of communication. Just as organisms are made up of different organs working together to sustain life, these elements in the communication system humans, messages, channels, contexts, feedbacks are part and parcel of the whole that is meaning making. This systems view of the nature of communication serves as a reminder to educators that successful communication is not just the result of clear speaking by a teacher or careful listening by students, but also of all other aspects of the system working together synergistically. The failure of a single component results in the inability for multiple participants to communicate such that communication breakdown, misunderstanding and confusion can be experienced if one or more components fails or is inadequate.

Building Theories for Communication Science: Biological, Social, and Political Elements The theoretical bases of communications systems emerge from different fields such as linguistics, psychology, sociology, information theory or semiotics. The linear model of communication (LMC) is a conceptual model used in the field of communication studies. It was proposed by Claude Elwood Shannon and Warren Weaver for Bell Laboratories in 1949.[1] The original model was designed to mirror the functioning of radio and telephone technologies. Though later models have added complexity and recognized the circular, interactive aspects of communication, Shannon and Weaver pioneered their concepts with a language of analysis that is commonly applied among scholars of various types. In our age, on this educational issue in modern discussion we understand communication systems as yet more than transmitting information into co-constructing meanings.

Constructivist and social-constructivist theories highlight that knowledge is shaped by the individual (or community), rather than passively received from an instructor who views himself as a "transmitter" of information to passive learners. This lens identifies students as co-constructors of meaning rather than receptor passively consuming information, the communication encounter is the product of each student's own speech and does not exist independent from it.

There are several criteria to evaluate the efficiency and effectiveness of a communication system. Accuracy is the coding loss caused if the decoding result matches exactly with its original message without any shift. Elements related to Clarity – The next set of aspects that need consideration is in relation to how clear and explicit your message may be. Relevance/causality: Is information reported in time to be useful? The completeness requirement is that everything necessary to understand the message be contained within it. Relevance refers to the extent to which communication style, channel, and content are right for context, audience, and purpose. In the educational domain, they enable educators to become aware of and improve upon their communication behavior as a means to improving student learning.

In addition, communication systems function in contexts that strongly affect the functioning of messages. I refer here to physical environment, or the actual place where people communicate - in terms of room structure, light, sound and seating. The temporal context includes the time at which communication is to occur as well as the ordering of communications. The social situation includes the interpersonal relationships, roles and statuses of the participants. Cultural context consists of the values, beliefs, norms and communication styles that are characteristic of a community. Awareness of these contextual aspects is essential for educators who must translate their communicative practices among different learning settings and student bodies.

4.1.2 Elements: Sender, Message, Channel, Receiver, Feedback, Noise

The following are some basic components which are found to work in unison to convey information and meaning. Each of these has a separate and unique, but interrelated function in overall teaching communication, and are critical for educators who want to maximize classroom communication effectiveness in the learning process. The Sender The sender of the message is the person or organization that creates and sends the message with a particular meaning in mind. Within educational environments, the sender is often represented by a teacher, but students also employ this role in conversation, during presentations and in peer interaction. The tasks of the sender are much more complex than merely talking or writing; he has to begin by formulating in his mind ideas that he wishes to convey, and then transform these mental constructions into a medium capable of being transmitted through some channel which he selects. This process of encoding involves the sender using words, behaviors, or visual symbols to convey a message in such a way that it is understood and correctly interpreted. Factors such as the sender's status, knowledge and ability to communicate, state of mind, and cultural orientation significantly affect both message construction and reception. Skilled senders in education have extensive content knowledge, appropriate pedagogical methods, a deep connection to learners, and understand how to communicate effectively across different audiences and situations.

The sender should also take into account who the receiver is, both in term of what they know, and how they best learn and communicate (language l status, educational level of development of C., etc.). This understanding of the audience permits the sender to create messages that are understandable, appropriate and persuasive. In the live classroom, minute-to-minute judgments about the appropriate difficulty of a vocabulary entry or sentence construction must be made in words and examples as well as metaphors and visual illustration that reflect what students are known to know and need to learn. In addition, the sender's nonverbal cues like facial expressions, tone of voice, body movements, posture and eye gaze significantly contribute to the interpretation as messages can also be communicated in attitude or stance and feeling through these non-verbal requisites: attitude may show assertiveness (standing straight), compliance (leaning forward) effecting reception accordingly.

The Message is the information (mental, verbal or written) from the sender that he wants to pass on to the receiver. Messages can be easy or difficult, literal or abstract, matter of fact or emotional, according to the purpose and context of communication. In pedagogical context, messages are commonly designed to afford instruction on concepts, theories, procedures, facts and principles students must learn. But communication also consists of messages that are not explicit but implicit, those of expectations, values, attitudes and social norms or rules conveyed by teachers in their daily classroom discourse as well as through how the class is being managed.

Messages are encoded in symbolic form and appear as such in one of the various media such as spoken or written language, mathematical notation, etc., in which a symbol system is used for expression. A message's success rests upon such factors as clarity, organization and coherence, relevance and accuracy of content, and the suitability of style. Good educational messages are logical and concise, using the appropriate level of detail without overpowering learners, grounding new information in what was already known about the subject, giving examples to demonstrate abstract concepts. Messages should be implemented with learning theories in mind, whereby all elements of the message contribute toward the desired instructional goals.

The messages themselves and the way they are structured must also factor in cognitive load. Educational psychologists differentiate intrinsic cognitive load (which is the inherent complexity of material being taught) and extraneous cognitive load (caused by how information is presented). Good teachers reduce extraneous cognitive load by structuring messages well, excluding useless information and applying relevant multimedia principles and scaffolding complex content with step-by-step approaches. In addition, messages may be multilevel communications which communicate not only literal text, but also meta-messages about the speaker-listener relationship, power differences or social expectations.

The communication Channel is the medium or conduit through which an encoded message moves from a sender to a receiver. Channels can be divided into various categories, e.g. natural channels; sound waves are a channel for the spoken word, light waves are a channel for what we see, and man-made channels; books computers projectors telephones learning management systems etc. In communication in face-to-face classroom interaction, several modes are operative at the same time: through the auditory channel we have textbooks voice and 'background' sounds in the room, through the visual channel facial expressions made by teachers or fellow students are transmitted as well as gestures of arms and hands and body-foot-distribution together with what is written on boards or what appears to screens, possibly things come about also by phases within different modes n an audio-odiac manner.

The communication channel has a large effect on the effectiveness of the message and what is learnt. Different channels have unique features with regard to their capacity, persistence, interactivity, and sensory modalities. Speech as an auditory communication medium provides immediate feedback, emotion conveyance and elaboration but it is also fragile, impermanent and memory based. Written material gives a permanent record that learners can process multiple times, but offers few nonverbal cues, and feedback is deferred. Visual media can effectively communicate spatial relationships, mechanism, and complicated data; however, they may depend on specific literacy skills. Multimedia techniques that utilize multiple modalities can facilitate learning by stimulating different sensory receiver systems and offering complementary representations of material.

Today, technology has considerably widened the number of communication arenas in educational settings. Synchronous communication on digital platforms can be enabled with tools like video conferencing, translating into the possibility of real-time interaction among individuals from different locations, while asynchronous communication is possible through online discussion forums, emails and recorded lectures allowing flexibility to learn at one's own pace. Every channel has its own set of affordances and constraints which an educator must take into account when designing for experience. The choice of channel should be based on learning objectives, characteristics of the content, learner preference and ability, available resources, and desired level of interactivity.

The Receiver of the message is the person or Listener group you are sending it to, your target audience in communication. In schools, receivers are typically pupils (although teachers are also used as receivers when pupil speak occurs). The task of the receiver is to receive the message communicated, transduce it into symbols and meaning, interpret meaning based on personal experience and understanding of cognate forms (knowledge), and understand or make sense of the communication. This is a process that goes far beyond simply listening to words or looking at pictures, it is an active cognitive process which involves attention, perception; memory recall, inference making and critical reflection.

Receivers contribute their own characteristics (for example, background knowledge and experiences, culture and values, language) to the communication encounter along with various unconscious (cognitive, learning preferences, emotional state) and conscious (motivation, expectations,bias) dispositions. These are “filters” through which messages are interpreted and, hence different people often derive different meanings from the same message. Successful communication involves that the sender take into account these receiver characteristics and tailor his messages accordingly, with the receiver working to understand what is being sent, asking questions and seeking clarification if necessary.

The idea of the active receiver is critical in an educational setting. Instead of being passive recipients who merely 'rent' transmitted knowledge, learners are knowledge constructors who selectively attend to information, associate it with existing mental models, and evaluate the credibility and utility of this vantage point in perspective within their framework. Such active processing can result in learning that transcends the literal message content, as when students infer from, elaborate upon, or apply what has been presented to them. On the other hand, active processing can also sometimes intervene in misunderstanding in receivers misinterpret messages contrary to senders’ purposes; thus, feedback that comes to verify understanding is a necessary part of any approach.

Feedback is the receiver's response to a message, which informs the sender how that message was interpreted and whether it met their expectations. Feedback turns communication from a monologue into a dialogue process and it allows senders to monitor the communication effectiveness and implement any changes if required. In the context of education, feedback is one of the most important aspects affecting effective teaching because it gives evidence to teachers (students' learning, misconceptions, confusion, engagement and progress toward teachers' target) in their teaching.

Feedback can present in a variety of formats: formal, informal, immediate to delayed; verbal feedback and non-verbal or unintended feedback. Structured feedback can consist of tests, quizzes, written answers, oral presentations and structured discussions soliciting evidence of learning.

Unofficial feedback consists of impromptu questions, facial expressions, body language, participation and verbal answers that convey whether student are following along and engaging with the material. Feedback provided during a communication event, or shortly after it, is immediate whereas feedback which follows reflection or assessment also gives well-considered responses. Verbal feedback refers to the spoken or written input, while nonverbal feedback includes gestures ap-goesez51O expression, posture and eye contact which transmit reactions and emotional states.

Great teachers actively pursue, and incorporate feedback in order to improve their teaching. They pose deep questions to gauge understanding, read student facial expressions and body language for signals that they are confused or cognitively engaged, designed formative assessment items that lay bare students' mental processes, establish climates where it is permissible to be confused and make thinking visible and several other similar kinds of things. Additionally, teachers comment on students' learning, presenting critically but constructive information that leads them to understanding areas they have mastered through their own knowledge and what else needs improving in order to enhance performance. The research is clear that Feedback of the Highest Quality is one of the most important predictors of student achievement.

The feedback process becomes a circular one in successful communication systems, where each response generates new messages and further feedback, in an endlessly repeated pattern of sense-making and mutual accommodation. In this way, communication is gradually polished, misunderstandings are undone, and common ground is cooperatively built up. In dialogic teaching, feedback is not just about getting the answer right or wrong but involves real dialogue where teachers and students learn simultaneously from sustained interaction of ideas. Noise Anything that inter feres with, distorts or reduces clarity, accuracy and/or effectiveness of communication is noise. Noise can arise at any level in the communication process including encoding of the message, transmission of the signal, reception and decoding and can be due to a variety of causes. Understanding noise is important for educators because reducing or controlling noise is critical in establishing optimal learning

environments in which effective communication can take place. Environmental noise is any physical noise in the communication process other than biological that prevents a message from being sent or received properly. In the classroom, environmental noise could be external sounds like traffic, construction, voices from another room or nearby playground activities that inhibit students' ability to hear the teacher. There may also be visual distracters including people walking by windows, busy classroom walls or poor lighting which make it difficult to see teaching materials. Physical noise, namely temperature extremes, uncomfortable seating, insufficient heating/cooling and poor acoustics can all interfere with communication and learning. Teachers can also control physical noise by creating a predictable learning environment (e.g., use of closed doors and windows, strategic seating arrangements, and sound systems when necessary) with proper lighting and temperature.

Physiological noise is caused by biologica-l or physical interference in listening intelligently to a message. From the sender's side, physiological noise could be voice quality issues, tiredness, sickness andalusite or physical pain that prevents from encoding and transferring their message appropriately. For receivers, they may be hearing, visually or attention disabled, having learning disabilities (including in the form of being hungry, fatigued or sick), which interferes with their ability to receive (see), discriminate and EXTRACT the message. Teachers also should pay attention to the health condition of students and should make reasonable adjustments, such as using preferential seating, computer software support, more time or a different presentation mode; to allow equal access to cs/communication & learning.

Psychological noise includes stress and other psychological states that impede communication. Anxiety, stress, anger, sadness, boredom, preoccupation with personal problems low self-esteem negative attitude toward the subject or teacher fear of failure lack of motivation etc., are considered barriers to learning and they form psychological noise that will interfere attention processes. In a similar way, teachers can experience frustration, burnout, and stress or hold negative attitudes about their pupils which may impede the flow of effective communication.

Positive and supportive classroom climates, strong teacher-student relationships, addressing emotional needs, encouragement and making learning relevant and meaningful can reduce psychological noise. Semantic noise comes from language issues resulting in a lack of clarity or comprehension. This can be in the form of unfamiliar vocabulary, technical language and jargon (extensive of their lexical range) that may be overlearned; unclear phrases that are equivocal or capable of being parsed in different ways; sentences run through so many layers they are difficult to unpack; idiom, metaphor and slang. The problem of sematic noise is especially pronounced in mixed classrooms where the students may have different language skills, cultural background and previous knowledge. Teachers reduce semantic noise by introducing new terms clearly, in language at the appropriate age level, accompanied by context and examples, checking for understanding frequently, and being aware of linguistic and cultural diversity.

4.1.3 Types: Verbal, Non-Verbal, Written, Visual

Types of Communication in the Classroom Communication in an educational setting occurs in many forms: both verbal and non-verbal, directly to students or indirectly through teaching materials and more. Awareness of these types of communication allows educators to choose and integrate approaches wisely in order to enhance teaching performance whilst promoting individual learning. Verbal Communication uses spoken words to carry messages, so it is probably the most common in the face-to-face environments. Oral communications includes, for examples, lectures and explanations up to unscripted dialogue or questioning as well as directions and feedback spoken by the same person that is heard. The immediate and interactive nature of oral language makes it especially useful in education, where teachers can deliver dynamic information, modify their explanations based on how students are responding, animate important points through prosodic contrasts and engage student learners in debate that is conducive to thinking and understanding.

The efficiency of verbal communication has a lot to do with many factors. Some degree of clarity of articulation make words pronounced recognisable to all. Reasonable pacing gives learners a chance to take it all in but doesn't get boring.

Volume, on the other hand, should be loud enough for all students to hear, if not feel but not too loud. Voice indicates attitudes, emotions and emphasis to students so they can grasp not only what is said but also how it should be interpreted and responded to. The words chosen should be within the students' linguistic competence, but new terms can be introduced more slowly to develop their growing language skills. Sentences should be written using proper language, but in an accessible manner.

The use of oral communication in educational context has many advantages. It facilitates instantaneous and reciprocal communication in which teachers can pose questions, solicit responses, correct misconceptions, and modify instruction on the fly through student feedback. Such accuracy leads to subtle voice variation, stress and strain on words and pauses etc that are an effective form of vocal emphasis, pace control and pause generation highlighting information as well as emotion. It promotes listening, speaking, vocabulary, and oral language skills. Through human voice, dialogue and rapport, it generates individual relationships. It is accessible to students who engage in auditory processing, allows for impromptu, supportive communication and addresses teachers' immediate needs.

But oral language also has inadequacies educators need to acknowledge. He spoke about spoken words being ephemeral, disappearing as soon as you use them, which can be challenging for those who have memory difficulties or for students who need a little extra time to process information. Language A verbal communication is dependent to a certain extend on whether or not students are actively attending and listening, something which can fatigue after an extended period of teacher talk. It could put students who are deaf or hard of hearing, who have auditory processing issues, or whose grasp of the language in which instruction is offered at a disadvantage. Without recording, there is no long-term record to review later. It is sensitive from physical noise, acoustics and environmental noise. Furthermore, too much teacher talk can encourage passive rather than active learning, and lecturing will be ineffective at developing students' speaking skills if used only in the monologue form instead of facilitating interactive dialogue.

Non-Verbal Language may easily be defined as communication without words, and it is the transmission of message through some means other than words. There is evidence indicating that for human face to face communication, the significance of nonverbal factors exceeds verbal communications, even some studies indicate as much of 93% of emotion is transmitted by nonverbal queues. In schools, teachers' nvs has a significant impact on the classroom atmosphere and student motivation, perceived teacher credibility, and the strength of student-teacher relationships. Facial expressions are one of the most potent means of nonverbal communication, with which we express a host of emotions such as happiness, sadness, anger, surprise, fear, disgust and interest etc.[(6] 7 The diversity of richness in the human facial expression is regarded by some as essential to understanding social interaction. A smile from a teacher can set the tone for an inviting environment, and frowns may mean that he or she is not happy with what is going on. If facial expressions that convey excitement, curiosity and warmth can be maintained, the eyes are more likely to focus on the web camera lens and students will have a vision in which they experience their learning to be important. But teachers have to be authentic as well, since students are unusually adept at discerning any gap between what a person says and how his or her face betrays that message.

Eye contact fulfills several significant roles in classroom communication. It forges links and establishes rapport from teacher to student (Sikorzynska, 2016), indicates attention and respect (Hellermann & Vergaro, 2003; Rampton, 1995) helps control turn-taking in discourse (Clark, 1996a), shows that the other person is interested and engaged (Poyatos-Rigo, c.p). And allows teachers to monitor comprehension through viewing facial expressions. With respect to the appropriate level of direct eye-contact, cultural norms are highly varied, and teachers should be sensitive to these variations. In some societies, making eye contact with the superior is respectful and shows interest, in others it may be considered disrespectful and confrontational. Effective teachers are informed by their students' cultural experiences, and adjust expectations and interpretations accordingly. Gestures are hand- and arm-movements that may fulfill different communicative roles. Illustrators support statements such as pointing to objects, showing how big or what shape something is, or showing us how we do things.

Emblems are culturally bound gestures that carry agreed upon meanings and which can replace words, such as a thumb up to indicate agreement or nodding. Regulators manage the flow of communication in various ways including putting up a hand to indicate they want to speak or making a "quiet" signal if noise gets too loud. Affect displays are the communication of feelings and attitudes. Appropriate and natural use of gestures can increase understanding, focus attention, and inject enthusiasm in lectures; but overuse or inappropriate gesturing may obstruct communication. It speaks, that is, the body says something about attitudes, emotions, confidence or powers. An open, upright posture with shoulders pulled back indicates confidence and authority; whereas a slouched, closed-off posture could indicate insecurity or disinterest. Walking the classroom instead of sitting behind a desk is more dynamic, easier to manage students, creates fewer physical barriers between teacher and students as well keeps children engaged with (EU1p:04) expectations. But frenetic pacing or agitated movements are disconcerting.

The field of proxemics, which focuses on personal space and physical boundaries of contact, demonstrates that teachers' positioning, their movement in the classroom communicative environment have a bearing on communication as well. Psychological barriers decreasing psychological barriers through moving closer to students can enhance attention and show that one is interested, while preserving proper boundaries in order to respect personal space and culture.

Paralanguage/ vocal qualities Paralanguage has to do with how something is said, as opposed to what is being said. And pitch, volume, rate, rhythm intonation and vocal emphasis all contribute to the meaning of spoken words. Using expressiveness and modulating your voice, you will keep your students attention, and cue them into what they need to remember; when the voice is monotonous there is an increased likelihood that he or she may become inattentive. Strategic pausing allows you to digest information, adds emphasis and build suspense. The voice can sound warm, enthusiastic, authoritative, sarcastic, disappointed or anything else that powerfully shapes the way a message is perceived. Teachers need to be aware of their vocal patterns and must learn how to control kinesics if they are to increase the effectiveness of communication.

The language of professional attire, grooming, and accessories sends strong signals about professionalism, credibility, personality, and values. Appearance should never detract from instructional content, but professionalism is hit by good appearance and demonstrates respect for the learning environment. "Culturally appropriate" appearance can be interpreted in many ways depending on the cultural situation dictated by institutions and academic levels. (For all of these activities, teachers should dress in ways that are professional, comfortable, culturally appropriate and suitable for the activity itself.) It’s also crucial to be able to interpret student behavior and response through non-verbal communication. Watching the look on students’ faces, their body language, eye contact and levels of attention tells me so much about what they know, find interesting or find confusion about — even how comfortable they might be feeling emotionally. Bewilderment may be reflected literally in the face (as if one were confused by what another said); slouching can connote boredom or tiredness; not looking someone in the eyes, discomfort or bewilderment; and leaning forward and nodding, comprehension or agreement. Expert educators are reading such nonverbal cues all of the time, and adjusting instruction for them.

Writing surrounds encoding messages in written language and preserve visual monogram of information that can outlive both sender and receiver. Written communication in educational settings involves not only textbooks, handouts, and assignment sheets, tests (printed or projected notes on boards or screens), written feedback on student work, emails, course syllabi posted in hardcopy or online and learning management system posts all the usual suspects of what is conveyed through a written text. Written language is essential to formal education and success in the classroom. Text has a few tremendous advantages. It offers permanence, giving students records they can read again and again to put concepts into long-term memory especially useful for material that's difficult or abstract and has to be understood over the course of days or weeks. It allows for crisp, well-planned communication in which teachers select words deliberately, structure information around purposeful topics and edit content so that it makes sense and is correct before transmitting to students. It can be used as a resource for students to reference throughout the school year, homework assignments, and when preparing for assessments

or simply brushing up on learned material. It meets both fast and slow learners, so that either can be pushed ahead as much as is good for him at a particular time. It is especially helpful for visual learners who have a hard time understanding information through listening. In addition, writing promotes critical literacy skills that are important in every field of study and in employment and civic life. Reading, students are exposed to complex vocabulary words and sentence structures as well as different types of text that will challenge them. By writing, students engender some structure in their thought, they gain skills to support claims with evidence, anticipate readers' needs, and revise for clarity or logic. These are requirements for success in the school and interaction within a literacy-educated society.

But when it comes to text, there are also hurdles. It involves literate abilities, which means that it might be a difficult tool for very young learners or students with specific learning difficulties to access. It is without the gestures, vocal stress and immediate possibility of clarification held by oral communication face to face, and could be misunderstood. It may be more time consuming for teachers who are creating materials on paper and it can certainly take longer for students to write out responses than to say them. This may feel a bit de-personalized, robotic even, in contrast to 'real people' interaction, especially when matters of relationship are involved. Confusing rather than clarifying is the effect of badly written work, not properly arranged, ambiguous in diction, too long or not sufficiently divided into paragraphs. Effective writing instruction for schools demands focus on a number of principles. There should be clear use of precise language, definition of technical terminology, and logical organization with smooth transitions. Brevity implies that only essential details should be included and not be wordy or redundant. Reading at the right level guarantees that vocabulary, sentence structures and the density of concepts are suited to students' ability. Visual accessibility is using fonts that are large enough, clear to read and provides space around the text, as well as headings, bullet points etc. which aid understanding. Interest is increased through engaging examples, applications that relate to student experiences, and diverse sentence

structures and tone. Instructional writing is intended content expression to satisfy particular learning objectives. Communication by visual means, including images, diagrams and symbols in conjunction with spatial concepts and color. In the learning environment, visual communication encompasses photographs, diagrams, charts, graphs and maps; illustrations from picture books and digital media; demonstration videos and animations in online settings; infographics; concept maps and graphic organizers; student or teacher demonstrations with models of processes like convection currents or chemical reactions as well as with materials for science experiments involving variables measured or manipulated. The idiom that is A picture is worth a thousand words demonstrates the effectiveness of visual communication for delivering intricate ideas efficiently and in a way that can leave lasting impressions.

It is advantageous to learn with visual communication. Visual representations help to make the intangible concrete and visible. They allow students to see relationships, processes, structures or patterns they may not be able to grasp through words only. For example, a diagram of the water cycle more effectively demonstrates the connections between evaporation, condensation, precipitation and collection than does verbal explanation alone. What is visual communication Visual communication transcends language, and learners with lower levels of the target language can access content. It involves the visual processing systems that complement verbal processing, and helps us with dual coding theory which states that any information that is encoded both visually and verbally are more easily remembered. Varieties of visual communication have their own particular uses. Real images, like photographs, are used as true to life depictions of objects and the world around us so students can make real world connections and practice observation skills. Figures and drawings used to illustrate accent important features or relationships or preparing while ignoring distracting information that can detract from what is emotionally relevant. Charts and graphs convert numerical data into a visual representation that is more immediate than tables of numbers in showing patterns, trends, comparisons we also produced several word counts the table on true number is one of them and relationships.

MAPS Maps are representations of spatial information about physical or conceptual spaces that provide an important tool for students to develop sense of geography, navigation, distribution and relation. Symbols convey traditional visual marks that represent ideas, which includes mathematical symbols, scientific notation and so forth as well as icons in digital interfaces. Video and animation provide movement and temporal sequencing to visual communication, which is particularly useful for presenting procedures (eg with surgical techniques), changes over time (such as evolution of disease) and dynamic processes. Videos can transport things from afar, in history or science or demonstration by experts to the classroom. Animations can depict a process that is too slow, too fast, too dangerous or too small to see directly. However, multimedia needs to be designed thoughtfully based on cognitive theories in order not to overload learners with overlapping visual and audio information.

Graphic organisers/Concept maps the visual representation of structures, relationships and tracks. The tools support students in organizing their thinking, making connections to ideas, and developing conceptual understanding. Venn diagrams map overlapping traits, flowcharts depict sequential steps or choose your own adventure style trees to follow, matrices present content based on rows and columns, timelines chart events linearly in time, while mind maps integrate ideas from the center of a concept out into satellite topics. In visual materials, colour fulfils significant communicative roles. Colors can be used to indicate categories, help recall crucial information, represent different moods or feelings, illustrate relationships and boost visual appeal. But color should be used creatively (in the original sense of the term, “to produce through imaginative skill”) and not merely decoratively with awareness of colour blindness, cultural colour connotations and the notion that too many colours can bring visual chaos rather than enlightenment.

Good visual communication needs to be designed. The principle of clarity recommends that we have clear idea in a visual and can’t display the content with extra ornament or over definition which will draw ppl' s attention to its decoration other than its content. Occam's Razor suggests that you should include nothing more than the details necessary, and strip away anything unnecessary. The Principle of Consistency Use similar visual styles, colors, and formats in related materials. The law of emphasis makes the critical features become viewer’s focus by size, color, position, contrast etc. Accessibility as the first principle that means: All learners, including those with visual impairments, must be able to perceive visuals in a way that’s understandable to them; e.g. through high contrast and large elements, clearly explained pictures etc.; Let’s not forget about the alternative text descriptions of images. Multiple forms of communication should be used in a strategic combination to enhance learning. Multimodal teaching, using the modality of spoken, non-verbal, written and visual communication engages several senses), caters to diverse learning styles/preferences (muster style) ensures that messages are reinforced through repetition and offers alternative ways of understanding. A unit on photosynthesis, for example, may involve verbal explanation, written notes or diagrams of the process, video examples of plant growth and development, hands-on experience with plants outside the windows or in the classroom and playful teacher gestures and emphasis. This layered strategy can communicate a very diverse group of students in a more effective manner than using any one type of communication.

4.1.4 Classroom Communication Models

A communication model offers a roadmap for how communication works; it is the blueprint or "chart" of an actual model, allowing the user to understand and interpret this extraordinary natural human function (Feece & Murdock, 2006). Different models have been proposed over the years, each focusing on different features of communication and yielding specific educationally relevant implications. Linear or Transmission Model is the very first model of communication that portrays it as a linear process with senders and receivers. This model originated in the work of Claude Shannon and Warren Weaver on their mathematical theory of communication (1949) and has also been analyzed as a linear sequence from source to receiver: with a message generated by a source, encoded into transmittable form at the transmission end, transmitted through a channel (radio wave or wire) which often introduces noise distortion; then decoded at the receiving end.

The model also recognizes noise as another factor that may obstruct the transmission of a message. This model, developed for telecommunications engineering, was introduced to Human Communication and would shape the early approaches in education.

In classroom environments, the linear model is equivalent to conventional lecture-based teaching in which a teacher (sender) conveys information (message) by speaking and showing slides or chalkboard writing (channels) to students (receivers), subject to possible disturbance from environmental distractions (noise). This model embodies a transmission-based peda gogy, such that teaching is conceived of as the act of depositing knowledge in students' heads--the "banking" model (Freire 1970). This approach has its limitations but it recognizes important aspects of communication and can still be helpful in making sense of some features of educational practice, especially where the purpose is primarily to convey a body of specific information quickly.

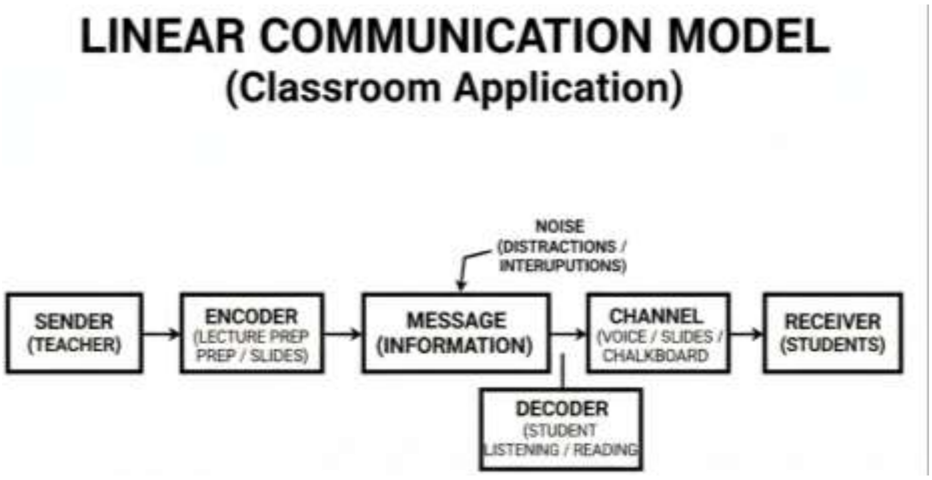


Figure 4.2: Classroom Communication Models

Yet, the linear model has been heavily blamed for its simplistic depiction of communication. It represents receivers as passive sponges rather than active creators, assumes continuous feedback does not matter, does not consider senders and receivers simultaneously (differentiations between them are irrelevant), ignores that communication is influenced by social and cultural contexts, & locates meaning in messages instead of participants. These constraints render the linear model inadequate in order to understand complex,

interacting communication processes that are characteristic of effective teaching and learning. The Interactive Model was a huge departure from the linear model, and argued in turn that communication is not one way device (that is from the source to the receiver) as traditional models suggested. Schramm and his colleagues in the 1950s and 1960s, this model retains the sender-message-receiver format but incorporates feedback loops that makes it possible for receivers to respond to messages so becoming themselves senders. The model highlights the role of exchanging as communication and the alternation by participants between sender and recipient. It also raises the notion of fields of experience, which is recognition that it is necessary for knowledge, culture and frame of reference among participants to be at least partially overlapped.

In an educational setting, the interactive model acknowledges that learning is only as effective as the teacher's ability to listen and respond to student feedback in real time. Teachers solicit questions and watch student responses to assess understanding, while students solicit questions and contribute answers to inform further instruction. This reciprocal feedback enables correction of any misunderstandings, regulating of the speed and complexity of instruction and confirmation that learning is in progress. The model also directs attention to shared experience, promoting the need for teachers and students to create common frames of reference, making connections between new information and what we already know, and considering cultural and linguistic diversity implications in creating a base of shared understanding.

The feedback-based interactive model is a more compelling representation than the linear approach since it allows feedback and offers the possibility of bidirectional communication. However, it still has limitations. It suggests that all communication involves sequence rather than simultaneous interaction, and therefore feedback is a discreet activity rather than an ongoing one; and it still conceives conversation as mostly being about message transfer, rather than the interpretation of messages. These restrictions inspired additional theory development. Least sophisticated is the linear view, with its assumption that communication has a beginning and end as well as a cause and effect. The interaction model isn't quite as partial to time linearity but still sees

communication in terms of give and take, sender and receiver; church leaders bring to mind images of sermons or discussions around them. You move from a list that includes the information you need stored on your phone itself along with other choices such as using Google's dial-in number. This leaves good stuff out, including my 1080: If Google fields complaints on missing native apps, they'd be less likely to get angry comments or dumb substitutes if all supported functions are listed. First developed in the 1970s by Dean Barnlund and others, this model reflects that people are not only senders or receivers but rather transceivers who encode and decode -process information exactly at the same time. Communication is conceptualized not here in terms of linearity or even circularity, but as continual dynamic transaction which take place between the interacting parties with a concomitant co-construction of meaning. The model accentuates that communication is nonparallel, irrevocable and unique, that the communicants continually affect each other and context permeates the process of communication.

Under the transactional model, context is multilayered. Environmental context refers to physical surroundings including spatial configuration, noise, temperature etc. The temporal setting includes communication temporality, i.e., time of day, moment in the academic term and historical period. This social context consists of relationships between the participants, roles and status hierarchy and dynamics within a group. Culture is a framework of commonly held values, attitudes, norms, and beliefs that are shared by the community. They are not simply in the background of communication, but they participate in constraining what can be said and how messages can be made use of and meaning constructed.

When applied to classroom talk, the model assumes that teaching and learning are processes of joint construction in which teachers and learners play active rule-governed roles and each influence the other's listening. As a teacher describes a concept, for example, they're watching students' faces, their body language and vocal outbursts, fine-tuning their explanation in the moment. At the same time, students are listening to (and judging) arguments made by other people5; processing what they hear into “yes,” “no” or don’t know,” as well as challenging it with their own experiences and thoughts; composing

questions before they interact with whoever generated the argument; evaluating credibility. Knowledge is grounded in the reciprocal, interactive dance, not the passive transmission model. The transactional model is consistent with modern learning theories that stress social construction of knowledge, active learning, and student-centered pedagogy. It’s conducive to dialogic teaching methods in which meaning is worked out between speakers through sustained interactions, not delivered monologically. It recognizes that students possess worthwhile knowledge, experience and points of view in order to inform classroom dialogue. It acknowledges that classroom speaking does a variety of jobs at the same time: conveying content, establishing relationships, controlling behavior, challenging power structures and building social identities. This broad perspective can contribute to educating teachers about just how complex classroom communication is and what many different things they need to pay attention to in order to be effective. Berlo's SMCR Model Berlo David K. Berlo's S-M-C-R model of communication is one that addresses again the issue of a source who as an individual, composed of skills and other factors is the sender/adaptor/receiver. Berlo also describes such factors for each of the elements. For the communicator and listener category of factors, these aspects are communication ability, attitude, knowledge status, social strata and cultural background. Taking the message, elements are content, items, their manipulation from treatment, break-up in format and tailcoat. For the channel, consideration follows seeing, hearing, touching, smelling and tasting. This model is especially important to educators, as it offers a systematic way of understanding why communication succeeds or breaks down.

In the classroom, for example, teachers may use Berlo's model to assess their own speaking, listening, writing and nonverbal (ie body language) skills as a communication process and then enhance those areas where they have weaknesses. Not entirely lost, though: they still might think about how attitudes towards students, to the subject matter or even to teaching have an impact on effective communication. They can make sure what they know is deep and up to date. Students can identify the ways in which their social and cultural location influences their usage and frame of reference.

With respect to messages, the teachers should be able to focus on content accuracy and relevance, element selection and arrangement, treatment suitability according to audience needs, clearness in structure definition as well as better access also by code. The choice of channel itself is strategic, according to the nature of content, learning objectives and student needs. Teachers who know about receiver factors are better able to differentiate instruction, scaffold it and make learning environments responsive to culture. The model in Schramm's articulation emphasizes understanding and the central role of mutual assumptions among desirers. Schramm suggested that communication happens to the degree to which sender and receiver fields of experience overlap that is, they share common ground in terms of knowledge, language, culture, and frame of reference such that they interpret the meaning. Of messages similarly. Under his model, sender and receiver are symmetrical partners in communication process, mutually constructing and conditioning of which messages are sent and response made. This field overlap itself is the measure of communication efficiency.

For teachers, Schramm's model shows the value of anchoring what's being learned in students' preexisting knowledge and their everyday experiences what Lev Vygotsky referred to as the "zone of proximal development." Effective teachers start teaching by activating prior knowledge, tap into familiar examples and analogies to make unfamiliar concepts more accessible, use plain language as they progressively introduce technical terms, and establish connections between students' nonacademic lives and academic topics. When working with culturally and linguistically diverse students, teachers need to work proactively to develop shared frames of reference while also respecting and incorporating the various perspectives that students bring into the classroom. The model also illustrates that the effective exchange of information is a transactional process, with the teacher trying to make his or her teaching accessible and thought-provoking for students, and students being involved meaning-makers.

The Constructivist Communication Model is grounded in constructivist learning theories that regard knowledge as being dynamically constructed by learners rather than passively transferred". This model places the language user at the center of communication, acknowledging that everyone makes sense of meaning through their own knowledge and experience, values and cognitive structure. From this view, communication in school is not a process of placing information and messages from the teacher into the heads of students, but that it enables students to define knowledge through their interactions with the content (text) peer, teacher and environment.

Implications for classroom communication practices the constructivist model has implications for how (p.iv) we communicate in the classroom. It recommends that teachers ask questions that promote thought rather than provide answers, engage in discussion where students articulate and refine understandings through talk, offer collaborative learning situations where students have to reason together to gain shared understanding, create experiences that promote the feeling of not understanding or even contradicting prior conceptions (cognitive conflict), and hear children’s thinking well enough to grasp their present conceptions and the reasoning behind them. The role of the teacher is no longer that of a provider of information but rather that of a creator of experiences and facilitator of discussion in order to help students construct their own understanding.

The model of dialogic communication is inspired by the Dialogism in the philosophy of Mikhail Bakhtin and has been further developed in pedagogy through theorist such as Robin Alexander. Within this model, dialogic exchange at the center of effective teaching and learning is foregrounded in a way that distinguishes genuine dialogue from mere Q&A sessions. Authentic dialogue includes both-way meaning making that goes on over time, impure thought which continually builds off one another toward more clarity and complexity of thought." This is accomplished through conversation protocols and structures that allow for sustainable, cumulative speaking/ thinking together.

It stands in contrast to a traditional IRE pattern that exists in many classrooms, where the teacher initiates questions closed to a specific right answer; students respond briefly before differentiating of frame responses; teachers immediately evaluate rightness and lock in-meanings (see Aukes [1995] for more on IRE).

IRE has its place for gauging recall, below that tasks often limit deeper thought and makes the teacher the sole authority. Dialogic strategies involve posing open-ended questions that invite diverse responses, providing students with extended time to voice nuanced reasoning, enabling response to answers rather than speaking solely in the direction of the teacher, challenging students' contributions with follow-up questions that require elaboration and justification, and promoting exploratory talk where understanding is developed collectively rather than predetermined. These different perspectives are not entirely incompatible but rather provide multiple insights into classroom discourse. Effective teachers make use of more than one model, and understand when information transfer is the right approach, when dialogue is essential, at which times mutual construction of meaning is most beneficial and where criticality adds a further dimension to learning. The choice of suitable communication strategies will depend in turn on the learning objectives, characterization of the content to be communicated, readiness of the students/audience, time availability and educational context. Combining elements of multiple models gives teachers a way to talk more effectively and, ultimately, work toward better student learning.

4.1.5 Barriers: Physical, Psychological, Semantic, Cultural

Although teachers strive for the best interactions among students, some obstacles come in the way of delivering, receiving and decoding messages in school settings. Knowledge of these barriers is critical for recognizing where communication fails and for devising ways to prevent or decrease those failures. Factors that impair classroom communication may classified into various categories, each involving its own unique challenges and necessitating separate interventions.

Physical Barriers include situational and physical/environmental barriers that can prevent a person from transmitting or receiving a message. With such physical barriers, you can obstruct excellent content and impact delivery when all other things are equal. In-classroom physical barriers manifest in several forms. Complexes are situated on or close to busy streets, and external noise like vehicles passing by, building construction, playground children, and neighbors studious in their classroom next door camouflages the teacher's voice. There is also internal noise of equipment in classrooms, students speaking to each other, furniture moving or papers crinkling. Its poor acoustics in classrooms with hard surfaces (not enough sound absorbing materials like curtains or carpet, sound reflective walls), high ceilings and large amounts of furniture can create echoes, distorted sounds and problems hearing from all corners of the room. Visual obstructions include poor lighting that's not conducive to visibility of written materials, visual aids or demonstrations which can be particularly challenging for hard-of-sight students. Examples of such obstructions include columns, pieces of equipment, or other students covering instructional displays from view. Writing is illegible on a board due to small lettering, lack of contrast between the text and background (e.g., blue or black writing on whiteboard), messy handwriting, light reflecting off windows or lights that interferes with the readability of notes on boards. The layout of the physical classroom can also hinder communication if students are unable to see the teacher, or materials such as a whiteboard where instruction is taking place, when distances between individuals in an instructional setting are too great for optimal interaction, or when room dimensions isolate students from each other and make it difficult engage in group learning activities.

Facilities: The extremes of temperature directly impact the level of comfort and concentration experienced by students when a room is hot, they become sleepy, and when it is cold, they experience discomfort and struggle to focus. Poor air quality can make for a brain-foggy day–and may even be bad for our brains long-term, according to researchers. Furniture that is uncomfortable, too big or in bad shape physically makes students squirm rather than learn. Crowded classrooms that fail to respect personal space because of which students often get overwhelmed and are distracted cannot lead to effective communication. Physiological barriers are those that result from physical conditions affecting the communicators. Students with temporary or permanent hearing loss may not perceive auditory information well. I can have trouble enough seeing anything in print as it is, let alone projected text or models. If students have difficulties with speech this can impair their verbal communications. Deferred attention as a result from not sleeping enough or overwork (or illness), decreases the ability of concentrating, information processing and good communication. Cognitive function and concentration are diminished by hunger and poor nutrition. Sickness makes people uncomfortable and distracted and sapped of powers of engagement. Accommodations may be needed to ensure accessibility to communication and learning for students with chronic health conditions or disabilities. To address environmental barriers proactive management of the environment and responsive accommodations are required. Educators may shut doors and windows during instruction, ask for loud activities to be conducted at other hours or employ white noise machines that muffle distracting sounds. They can configure classrooms with purpose to make the most of lines of sight, reduce distractions, encourage engagement and provide for different activities. Provide good lighting, high contrast colors for visual materials, appropriately sized font and where to stand so that the student can see them. Pop amplification systems when such are warranted, especially in large areas or for students who have difficulty hearing. They can track temperature and ventilation, and then press for improvements when conditions fall short. They offer accommodations to students with disabilities such as assistive technology, preferential seating, larger print format materials and adaptations or exceptions for assignments and testing.

Psychological Barriers: Psychological barriers are of the mind, as well as its attitude and emotion that hinders communication and learning. Physical barriers are relatively easy to see, while psychological ones hide on the inside and can be a lot more difficult to identify and remedy. They can be just as or even more influential than physical barriers on obstructing classroom communication and student success. Anxiety and fear are daunting psychological obstacles in learning situations. Test-related anxiety includes an excessive concern or fear develop about academic success, which can disrupt cognitive processes and impact recall as well as demonstration of learned materials. Fear of communication or public speaking can hinder students from asking question, discussing and presenting so as to restrict their engagement and learning. Fear of failure leads students to shy away from challenging tasks, to disengage when tasks are difficult, or to give up early rather than persist. Fear of rejection by teachers or peers may hamper risk-taking, creativity and self-expression.

Communication and Instructional Design

This may have implications for teachers given that fear of judgment or performance anxiety can hinder one's ability to spontaneously, communicatively and interactively engage with another (Levick & Thubragy 2008); due consideration should be given to classroom discourse. A person with negative self-confidence or low self-esteem will not feel good about themselves and may have a poor attitude when it comes to communicating with people. Such self-perceptions may become self-fulfilling prophecies students who perceive themselves to be low achievers experience academic disengagement, opt-out of participation efforts or do not work hard enough. On the other hand, there is a double-edged aspect of overconfidence when accompanied by ignorance and students are not aware that they do not know or cannot measure their level of knowledge."

Unit 4.2: Instructional Design Models and Theories

4.2.1 Behaviorist Theory: Stimulus-Response, Reinforcement

One of the core theoretical orientations to human learning and development is behaviorist theory, which was a significant force in the first half of the 20th Century when early psychologists such as John B. Watson, Ivan Pavlov, and B.F. Skinner laid much of its groundwork in stimulus response principles (Santrock Jr., 2014). The theoretical idea behind activism is essentially one where learning is assumed to be the result of observable patterns of behavior, with the environment critically influencing these changes in behavior. The behaviorist position purposefully redirects attention from the presumed no observables of mental states to observable behaviors and actions that can be related in a systematic manner, and as such measured.

The stimulus-response relationship underlies behaviorist learning principles and is the simplest level of behavioral analysis. This was the idea that had been developed by Pavlov in his famous dog experiments, where he demonstrated that unconditioned responses could be established for neutral stimuli simply by repeatedly pairing the two. In the classic experiments, Pavlov noticed that dogs would drool when they experienced food, which became an unconditioned response to an unconditioned stimulus. But after pairing the sound of a bell with being fed many times, the dogs began to salivate when they heard just that sound alone – even if no food was in sight. This was a clear case of classical conditioning, or associative learning in which the formerly neutral stimulus had taken on the power to evoke a response after being paired with a meaningful one. The significance of this finding reached far beyond the realm of dog behavior and posited that a considerable extent of human learning could rely on analogous associative processes.

Expanding upon this groundwork, Watson subsequently developed behaviorism into a more complete psychological apparatus that he believed could account for all complex human activities by reduction to connections between stimuli and responses. He was fond of saying that if he could control the environment in which a baby developed during their first 5 years, he would be able to make a baby turn out to be any kind of specialist

be able to make a baby turn out to be any kind of specialist, no matter what sort of talent or inclinations that child might have been born with. Even if this view was exaggerated, it reflected behaviorist's belief that learned events are more important than inborn potentials in controlling actions. Watson's study of Little Albert, in which he conditioned a small boy to become afraid of a white rat, due to an association with loud noises, was the first known cause-and-effect demonstration that fear could be transmitted from one stimulus to another through classical conditioning (note that this experiment was highly unethical by today's standards).

The reinforcement paradigm especially that attributed to B.F. Skinner profoundly transformed understanding about how animals learn behaviors, maintain them and change them. Skinner made a clear distinction between his methodology, which he called operant conditioning and had previously been referred to in some instances as instrumental learning, by suggesting that the organism worked on its environment to create consequences. In operant conditioning, behavior is either strengthened or weakened by the consequences (rewards or absence of rewards) they produce. Positive reinforcement is presented when a behavior is followed by a stimulus that is appealing or rewarding, increasing the chances of that behavior being repeated. For example, if a student is positively recognized for turning in homework assignments, the positive attention serves as reinforcement which then makes them more likely to do their homework in the future. Negative reinforcement, and it’s a concept that’s often misunderstood as being punishment, but actually, negative reinforcement is about removing things following behavior that makes the behavior more likely to reoccur. For pain medication taken for a headache, this could mean that the positive reinforcer is the removal of headache (i.e., negative reinforcement), with conditioned relief of head pain serving to reinforce taking more analgesic.

Skinner painstakingly classified various schedules of reinforcement, revealing that the nature and timing of reinforcement strongly influences not only the rate at which learning occurs, but also how resistant to extinction a particular behavior will be. A flat rate of reinforcement (FR), in which each instance of a

behavior is reinforced, leads to fast initial acquisition in a behavior but also results in rapid extinction once reinforcement stops. Partial and intermittent reinforcement schedule, where some but not all behaviors are reinforced lead to slower initial learning (acquisition) but much greater resistance to extinction. Fixed-ratio schedules of reinforcement deliver rewards after a specific number of responses, and variable-ratio schedules provide them unpredictably, according to an especially resistant behavior. Fixed-interval schedules are applied after a set interval of time, while variable-interval provide reinforcement at delivered during unpredictable intervals. These behavioral principles have been widely applied in the field of education, as instructors employ reinforcement schedules to induce the acquisition of new knowledge while encouraging students to remain engaged with educational material.

Punishment (opposite of reinforcement): A punished behavior is less likely to occur because an unpleasant event occurs as a consequence of the behavior. Punishment may be able to suppress undesirable behaviors (suggestion), however, many behaviorists have reported limitations and possible negative side effect. Punishment is generally only a temporary suppressant of behavior rather than a permanent extinguisher, can create fear and avoidance reactions, often damages the relationship between punisher and punished or becomes an aversive stimulus in itself, and infrequently teaches an appropriate replacement response. As a result, behaviorist training tends to focus on reinforcement of desired behaviors rather than punishment of undesired behaviors; however it is certainly not unusual for a behaviorist and trainer to use punishment in an effort to train "away" the undesired behavior. The spread of behaviorist influence is evident in areas such as applied or practical psychology, including education, therapy and parenting, coaching, the treatment of mental disorders and behavioral problems (such as autism), organization management; animal training. At school, behaviorist methods are evident in classroom management, teaching patterns and assessment.

Educators design learning environments that establish clear expectations, actions and consequences for academic or behavior progress. The programmed instruction, computer-assisted learning, and mastery learning models all leverage behaviorist theories by sequencing skills into smaller parts, delivering prompt feedback on success or failure,

and requiring mastery before moving forward. Applied behavior analysis programs use the principles of reinforcement to modify behavioral problems, such as classroom disruptions and skill deficits for people with developmental disorders. Behaviorism, great in its reach and application, has been subject to criticism and limitation. Critics of behaviorism claim that the behaviorist's focus on overt behavior ignores critical cognitive processes such as problem solving, decision making, thinking and perception. Human learning obviously goes well beyond mere stimulus-response conditioning to include more intricate mental representations, strategies, and metacognitive awareness. Behaviorism has problems of its own in accounting for the learning of language, creative problem-solving, insight learning and the rapid acquisition of complex cognitive skills that are not readily reducible to successive shifts in behavior. In addition, the theory's mechanistic model of human action as being totally under the control of external contingencies leaves no room for human purposes, intentions and capacity to learn and change purposefully.

However, the behaviorists' perspective still offers useful insights and powerful methods for analyzing and shaping behavior. Contemporary educational and therapeutic models commonly combine behaviorist methods with cognitive and humanistic frameworks, acknowledging that although environmental contingencies have a profound influence on behavior, they are modulated by internal cognitive and motivational processes to determine learning outcomes. Applied behavior analysis that focuses on the application of radical behaviorist principles to support socially significant behaviors, including interventions for learning disabilities, autism spectrum disorders, and addictions has demonstrated its efficacy. The objective and measurable nature of behaviorist techniques also recommends them in the evaluation of therapeutic interventions, accountability in treatment contexts and educational settings.

4.2.2 Social Cognitive Theory: Modeling, Observational Learning

Social cognitive perspective A major theoretical development that integrates behavioral and cognitive views of human functioning while adding its unique type of social dimension represents the emergence and evolution of social cognitive theory, which is attributed largely to Albert Bandura (e.g., in his

works as Bandura et al., 1961; Priester et. This framework was developed in reaction to Bandura's frustration with how strict behaviorism had failed to account for the acquisition of complex behaviors in absence of reinforcement, and its lack of concern for the influence exerted by social context on learning. In contrast to the notion of people being passive recipients or reactors to environmental contingencies, social cognitive theory depicts them as proactive contributors to their life circumstances who set and pursue goals, monitor progress in relation to goal pursuit, and establish courses of action and modes of self-regulation they have learned from others.

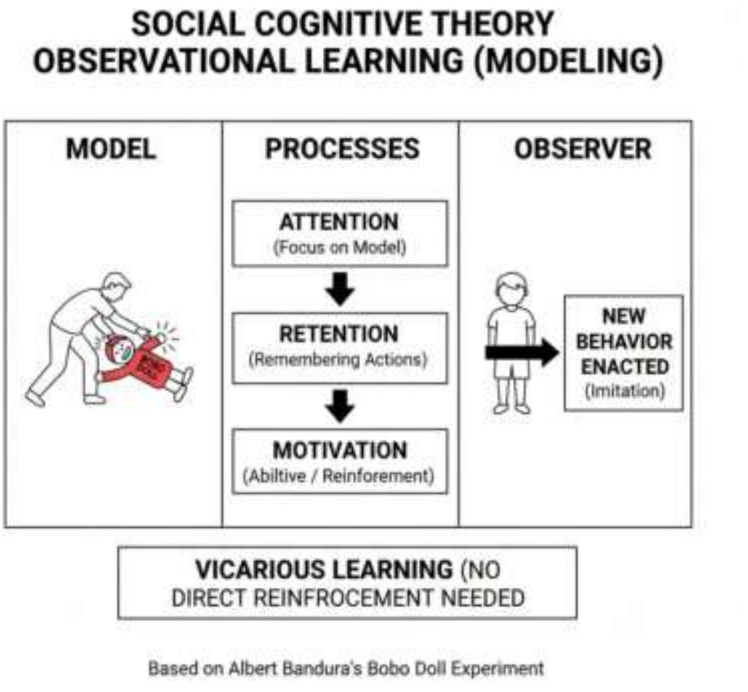


Figure 4.3: Social Cognitive Theory: Modeling, Observational Learning

The idea of observational but also known vicarious learning or modelling was both the technically most novel and has become the socio cognitive theory's most enduring legacy to psychology. Bandura’s famous Bobo-doll experiments graphically illustrated how children could learn new behaviors by observing others do them, without receiving any explicit reinforcement or being given opportunities to practice. In these works, children who observed an adult aggressing towards a bobo doll emitted similar aggressive acts when the opportunity was made available, despite having never been rewarded for doing so and such acts never having actually practiced. This was disruptive of a behaviorist view that learning always involved direct experience and reinforcement, but it confirmed the idea that humans are extremely good at accelerating their own learning through observation and imitation.

Observational learning works through four subfunctions the Bandura recognized as necessary to model but that are not pieces of modeling. The process of attention allows us to selectively attend to the salient aspects those behaviors of the model at hand that are relevant, while ignoring irrelevant details. Obsewers' focus on the model is determined by various factors including characteristics of the model (e.g., competence, status, attractiveness and similarity to the observer), as well as characteristics of the modeled behavior (complexity; distinctiveness; functional value). Learners cannot learn things they do not attend to so attention is the door through which observatory learning passes. Teachers and parents understand this principle instinctively when they get children's attention before modeling new behaviors.

The retention mechanism includes the symbolic representation of observed behaviors in memory via cognitive encoding and storage. Bandura (1977) emphasised that observational learning was based on cognitive, rather than behavioural processes. Verbal coding, describing modeled behavior in words Imaginal coding, imagining the actions of the model being reinforced. Such cognitive representatie on s enable humans to remember and replicate behaviors even after a delay commensurate with TV's spaced timing. Rehearsal, either mental or physical, reinforces these memory traces that is why people mentally rehearse when they want to replicate how they do procedures.

A component that is specific to the reproduction domain is the process of translation from symbolic expressions of movement into activation, which means that observers have to be capable to physically and cognitively replicate the behavior. Observational learning can also occur before immediate reproduction, as when very young children imitate the complex behaviors of adults; they cannot reproduce them at the time but do so some

years later. But in general translating from observation to even a skilled performance usually takes considerable practice, feedback, and iteration. This improvement process guided by a self-observation of his or her attempts is made comparing the efforts done with remembered standards of performance (model).

Motivational factors are critical in determining whether observational learning leads to performance, or whether other factors intervene; this was a central tenet for Bandura, who believed that acquisition and performance were separate phenomena. People might acquire the actions through modeling but choose not to perform them for motivational reasons. Vicarious rewards (seeing a model rewarded for behavior) increase the chances of imitating an observed behavior, and vicarious punishment (seeing models being punished or experiencing negative outcomes) reduce performance likelihood. Self-reinforcement, feeling good about yourself because you meet your own standards of behavior, and direct reinforcement are also affected by whether or not you engage in behaviors. This difference between learning and performance then explains why people have many behaviors they do not perform.

Bandura sketched out the idea of reciprocal determinism, in which personal factors, environmental influences and behavior all affect each other two-way. In contrast to behaviorism's profound environmental determinism, reciprocal determinism acknowledged the fact that human beings are products and producers of their environments. Personal variables (perception, beliefs and feeling) determine the kind of environmental conditions people choose to produce or select, which are essential for thoughts and actions. At the same time, personal and environmental conditions affect behavior in that behavior often produces consequences (in each realm) to initiate thought and change environment. This model of triadic reciprocal causation links environmental influences with personal and social factors, leading to an understanding of human functioning that accounts for the role of agency in these processes.

Self-efficacy, which refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments) is another fundamental premise in social cognitive theory.

Bandura (1997) contended that self-efficacy beliefs are strong predictors of motivation, perseverance, resilience to challenges and performance in different areas. Individuals with high self-efficacy establish ambitious goals for themselves and have the wherewithal to stick forth even when they face obstacles, whereas those with low self-efficacy give up sooner and are more apt to make attributions that are unconstructive. On the contrary, for weak self-efficacy individuals, they lose confidence in their ability to perform well, they refuse difficult tasks, when faced with challenges they easily give up and feel anxious and depressed when there are expectations.

Four sources of information underlie people’s judgments of their own capabilities (self-efficacy). Mastery experiences (i.e., one's perception of performing successfully during a task) are also the strongest source of efficacy information, and failures particularly early in skill development diminishes an individual's belief in their own capability. When vicariously experiencing success of a similar other, watching same others struggle and succeed aids observers in judging their own self-efficacy when they have no empirically derived information about the experience. Social persuasion, which includes encouragement from others as well as receiving positive feedback from credible sources, can increase self-efficacy but it is for the most part weaker and less endurant than that of mastery experiences. Physiological and affective states shape efficacy judgments by a perception of vulnerability (anxiety, fatigue, stress) versus capability (positive mood, bodily energy).

Social cognitive theory has important educational implications. Teachers are strong role models whose actions, attitudes, and approaches students ‘spot and adopt in the classroom. In addition to the overt model of explicit instruction, teachers are implicitly modeling how to learn, figure things out and persist (Palincsar and Brown 1984), making it important that they be clear in their demonstrations for students about the thinking and strategies guiding their own efforts. Peer modeling is especially powerful because students view peers as more similar to them than adults, so peer success stands as persuasive evidence of their own capabilities. Cooperative learning formats, peer tutoring, and group

projects all utilize peer modeling while also giving students experiences in group learning and practicing self-efficacy through task success. According to social cognitive theory, self-regulation fosters the development of students' learning ability to be in charge of their own learning by setting goals, strategic planning, monitoring behaviors, evaluating actions and reinforcing success. Education mustn't be limited to pure external control and reinforcement; it should gradually delegate the regulatory activity to learners themselves, empowering their autonomy and long-life learning propensities. Educators facilitate the development of self-regulation in students as they explicitly teach metacognitive skills, offer purposefully planned occasions for self-monitoring and reflection, and fade support once a student displays higher levels of independence.

Current uses of social cognitive theory in media effects, health behavior change, organizational learning and psychotherapy. The literature on media violence provides converging evidence that children and young people have a tendency to learn attitudes, emotions, and behaviors from an exposure to violent television programs, movies, and video games. In health promotion, the modeling approach has been used to teach and encourage various types of health-protective behaviors such as exercise, nutrition, and prevention and management of illness. Organizations are aware that people learn on the job by observing colleagues and mentors, not just through formal training. Modeling and the enhancement of self-efficacy are employed in cognitive-behavioral therapy for the treatment of such psychological disorders as phobias, depression, and anxiety.

4.2.3 Constructivist Theory: Active Learning, Scaffolding

Theoretical frame Constructivist theory adopts significantly distinct epistemological position for knowledge and learning, which argues that individuals are actively constructing meaning by their environment rather than being passive recipients of information from the external world. This view, which has been advanced on philosophical grounds by Immanuel Kant and in educational theory by John Dewey, became psychologically sophisticated in the work of Jean Piaget on developmental stages and Lev Vygotsky's sociocultural

theory. Constructivism offers an alternative to more traditional transmission models of teaching, in which content is "delivered" by teachers through a didactic approach and learners play a relatively passive role in the learning process (Simonson et al., 2006); it suggests that students construct knowledge from experience, reflection and social interaction rather than passively receive it. Cognitive constructivism is based on Jean Piaget's genetic epistemology, which highlights children's active construction of progressively more complex understandings as they actively interact with their physical and social realities. According to Piaget, cognitive development advances through a series of distinct stages, each marked by markedly different ways of thinking and understanding the world. Cognitive structures, which Piaget labeled schemas, are mental or behavioral patterns that people use to interpret and respond to experiences. Learning results from assimilation and accommodation. Assimilation is interpreting new experiences in terms of existing schemata accommodation is a process of modifying existing schemas or developing new ones in response to encountering new situations.

Active learning lies at the heart of constructivist pedagogy, which holds that both discovery and understanding are facilitated by active study rather than by passive reception of explanations from teachers. Constructivists posit that knowledge cannot be transmitted merely by words from teacher to student;

rather, students must each actively construct personal understanding through mentally and physically active experiences. That’s not to say that teaching is unnecessary or that discovery alone is enough to learn. Instead, skilled teaching offers a wide range of experiences, thought-provoking questions and meaningful support, whilst acknowledging that the ultimate construction of meaning is in the hands of the learner. Activities should encourage cognitive engagement: students should be analyzing, synthesizing, evaluating and using the information rather just memorizing and regurgitating. Liben, 2005) It is noteworthy that constructivist pedagogy emphasizes hands-on experience with physical objects as children in the concrete stage develop sense of within a domain by1- interacting directly with those objects and events rather than talking alone teachers or other interlocutors. Piaget showed that young children reason in qualitatively different ways from adult and they need practical,

concrete-operation support before the purely abstract thought is possible. In mathematics, science and across disciplines manipulative, laboratory investigations or project-based learning give students the experiences they need in order to build understanding. Nonetheless, constructivists also acknowledge that manipulation of objects is not sufficient for learning; cognitive activity and thinking about experience (meta-cognition), in terms of making sense, are significant. Cognitive conflict or dissonance is a potent trigger of conceptual change in constructivist paradigms. When learners encounter events that conflict with their current understanding, they experience disequilibration, an uncomfortable state of cognitive dissonance that encourages accommodation and schema repair. Teachers can intentionally generate such conflicts by introducing discrepant events, posing discrepancies to students’ previous ideas or eliciting boundary situations in their thinking. But the disequilibrium has to be in students' zones of proximal development: It must be difficult enough to force restructuring but not sufficiently out-of-whack to have it ignored or rejected with much frustration.

According to Lev Vygotsky, sociocultural theory extends constructivist learning theory and states that the mind and culture are inseparable and interdependent. Higher mental functions serve as the origin: they are first formed in relations between individuals and within them, then gradually become their internalized property. Thinking is deeply influenced by language and other cultural tools, and cognitive growth depends upon the learning of culturally inherited systems of symbols. Development and learning are interchangeable because social interaction within the zone of proximal development creates opportunities to participate in what have become independent activities, leading first to an inter psychological level of functioning and finally allowing for the internalization of those skills into intra psychological functioning over time.

One of Vygotsky's most influential concepts was the zone of proximal development, which is the area between what children can do by themselves and what they are capable of with help from others who are more skilled. It is the area where instruction is most efficient, because here the task demand is sufficiently great to promote growth but not too great to be unattainable with proper support. Works below the zone can be done independently -- with some, but not much, opportunity for learning -- while work above it is so difficult that students cannot do it even when helped, and become frustrated rather than empowered. Teaching is impactful when it occurs in the zones of proximal development, challenging and supporting students to accomplish what others cannot.

Scaffolding, a metaphor developed by Jerome Bruner and associates to implement Vygotskian theories into pedagogical practice, encompasses the facilitating conditions that teachers and those more experienced render in order of students to achieve their zone of proximal development. Just as construction scaffolding firmly holds a building parallel to supporting it while it being built, instructional scaffolding (whether physical or virtual) is what supports students as they build their understanding and develop new skills. Effective scaffolding consists of a number of components including contingency, allowing support to be adjusted according to performance; fading, the progression toward withdrawing support as knowledge and skills develop; and transfer of responsibility, gradually shifting control from teacher-operated activity management to learner self-management.

Scaffolding comes in various shapes according to task demands and learner needs. Cognitive scaffolds may include such supports as breaking an activity into various smaller tasks; offering thinking prompts or question stems; or making expert thinking transparent through think-alouds. Scaffolding for emotion attends to motivational and emotional dimensions of learning, promotes perseverance, reassures and congratulates effort and progress. Strategic scaffolding helps students acquire general problem-solving strategies, metacognitive skills, and self-regulated learning that can transfer to new domains. Types of Scaffolding Material scaffolds sequencing activities, supplying structured templates or graphic organizers, and supplying partially completed examples to reduce cognitive load but maintain a meaningful problem-solving challenge. The speakers' timing and his/her withdrawal from scaffolding needs a lot of instructional skill.

If you support too much, students become dependent on you AND they are robbed of the good kind of struggle learners need in order to think deeply. In contrast, lack of support results in confusion, misunderstanding and less motivation. Good teachers are continually evaluating students' comprehension and provide support in real time, adding more when kids need help and less when they show they're on course. The macro-characteristic of scaffolding is that needs to become obsolete, letting learners take the support from outside to inside and becoming autonomous.

Collaboration Another underpinning in sociocultural constructivism is collaboration, which acknowledges that cognitive development takes place within a social environment where meaning-making results from dialogue, negotiation and cooperative problem solving. What learners are able to do in collaboration today they will be able to do independently tomorrow Vygotsky this quote emphasizes the developmental role of collaboration. Peer discussions help students to express thinking, hear other viewpoints, negotiate meaning and generate shared understanding that transcends what any individual alone creates. But productive partnerships also need to be well-structured; it's not just the mere placing of students in clusters as a way to assure learning. Good cooperative learning includes positive interdependence, individual accountability, direct social-skills instructions, and carefully thought-out interaction structures.

Talk in the classroom is a central concern of sociocultural approaches, with talk being considered as both means and object of learning. In contrast to the teacher-dominated recitation routines with known-answer questions or turn-by-turn evaluation of student answers, a constructivist classroom supports true discussion in which students express their reasoning, respond to other's thinking, pose authentic questions and co-construct knowledge. Teachers' orchestration of rather than monopolizing discourse, including rejoicing to articulate and validate children's contributions, challenging reasoning and requiring justification, fostering child-to-child interaction and positioning the children as competent sense-makers their ideas deserve careful consideration. The teachers" role changes significantly in constructivist settings from the traditional transmission methodologies. Instead of being the main source of knowledge teller and evaluator for students' reproduction of presented information, in constructivist classrooms teachers act as learning facilitators, creators of learning landscapes, and supports to students' construction of knowledge. Teachers create these rich learning experiences, ask students to think deeply about content they present and how they can leverage it appropriately to foster deeper understanding, provide scaffolding where appropriate, construct a pathway for peer interaction for sharing knowledge creation amongst peers, and help students understand that "how" is just as important as the "what." They tend to students' thinking: they actively solicit and respond to student thinking, including formative assessment constructively used in the service of understanding where children are currently and teaching from there. This is a challenging job that requires deep subject matter knowledge, pedagogical know-how and complex understanding of how students think and learn.

Critics of constructivism ask important questions about misuse and qualifications. At the same time, the more extreme expressions of constructivism have at times marginalized the role of explicit instruction and skill development as well as transmission of accumulated human cultural knowledge that may be especially beneficial for students who do not receive strong support from home or already possess robust prior knowledge in a particular domain. Discovery alone, however, is not as effective as guided instruction which combines inquiry with teacher support that moderates the student-guided conceptual construction. Certain constructivist discourse underplays the need to become fluent in basic skills and have access to basal procedures. Moreover, there are few instructors willing to invest in the amount of time that such a constructivist approach requires – a point of particular challenge when the curriculum is extensive by itself.

There is a growing body of modern research that favors balanced approaches that allow constructivist pedagogy to be overlaid with some aspects of direct instruction offering active construction time and explicit teaching of important knowledge and skills. The cognitive load theory imposes very valuable

limitations on constructivist pedagogical solutions because the novice learners are found to have only limited working memory resources available and, therefore, learn from guidance which it is provided to them reducing unnecessary mental load. By teaching these starting skills and knowledge directly, we build a foundation that allows students to go on to do higher level constructive work. The best teaching is one that draws from a variety of teaching practices and adapts instructional approaches to the learning goals, characteristics of the contents being learned, and the needs of learners, rather than a single theoretical orientation.

4.2.4 Psychoanalytic Theory: Motivation and Unconscious Factors

The psychoanalytic tradition, developed by Sigmund Freud and colleagues in the late nineteenth and early twentieth centuries, has a unique perspective on human growth and learning that focuses on unconscious psychological functioning, affective processes, and the powerful contributions of early childhood experiences to personality development and adaptation. Although psychoanalytic views have had less of an impact on educational thought per se, than either behavioral or cognitive theory, they offer some people quite important insights into motivation, affect and learning in particular into teacher-student relations as well as to the non-rational realms of human behavior which may be ignored by more purely cognitive approaches. Modern psychoanalytic paradigms have moved far beyond classical Freudian thought, integrating object relations theory (including attachment theory) and self-psychology in more sophisticated models of human development.

The Freudian structural model of the mind's theory that interpersonal experiences are structured through interaction among three mental systems. The id is the call of nature, the instinctual urge to satisfy selfish desires, which functions on the pleasure principle and does not acknowledge reality or morality. A hereditary component, the id is the storehouse of unconscious psychic energy driving and governing all mental processes. The ego forms from the id during infancy when children learn to control their behavior on the demands of reality; it acts according to the reality principle, i.e. it seeks to please the id's drive in realistic ways that will benefit ultimately rather than bring grief.

The ego uses logic and reasoning for planning and problem solving to fulfill needs in a way that is realistic and socially acceptable. The superego evolves in early childhood by identification with the parents and includes societal and parent values to constitute conscience and ego ideal. The superego produces guilt when its moral imperatives are transgressed and pride when they're met.

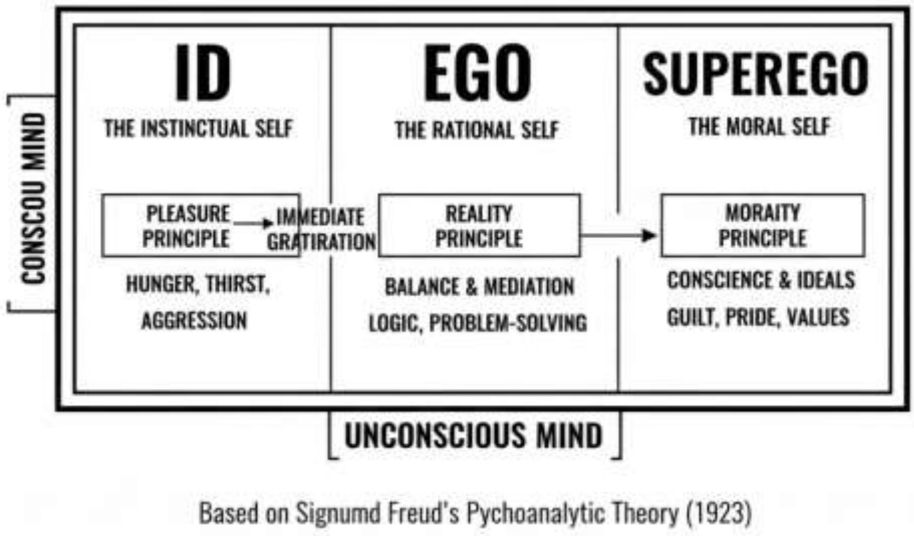


Figure 4.4: Psychoanalytic Theory: Motivation and Unconscious Factors

AAAs play a central role in psychoanalytic theory, and Freud believed that most human mental activity occurs outside of conscious awareness. Unconscious thoughts, emotions, memories, and motivations tend to control behavior in ways that people cannot detect or comprehend. Defenses are unconscious machinery that the ego uses and as part of its efforts to resolve conflicts, tensions created by needs of the id, demands of superego, and constraints imposed on us by reality. Repression the most basic of all defense mechanisms is an active attempt to push threatening information out of consciousness. Projection in which one's own unacceptable impulses are attributed to someone else, and displacement where emotional energy is moved from threatening targets to harmless substitutes. Sublimation is the most adaptive defense mechanism, where socially unacceptable urges are redirected into a more acceptable aim. Rationalization is an attempt to justify behavior that is motivated by unconscious forces (impulses) but unacceptable reasons that are addressed.

Psychoanalytic approaches to motivation focus on unconscious drives and conflicts as opposed to conscious goals or rewards. Freud originally theorized the phenomenon of human behavior as ultimately being based on two instinctual drives: Eros, the life or erotic instinct (broadly understood as sexual or creative energy), and Thanatos, the death drive that expresses itself in aggression and destructive behavior. Subsequent theorists revised and elaborated on these ideas, but the basic point is that motivation consists of complex interplays of biological drives, unconscious fantasies, internalized relationship patterns, and defensive operations. Learning motivation and difficulties are not necessarily cognitive deficits or insufficient reinforcement, but often unconscious emotional conflicts or relationship issues.

According to psychoanalytic developmental theory, the first few years of life are thought to be particularly critical in determining personality structure and later functioning. Freud developed a theory of psychosexual development, which described five stages in the development of libidinal energy and psychological conflict related to what areas of the body were invested. The oral stage of infancy resolves around biting and breastfeeding, with good (bad) caregiving leading to trust (mistrust). The second-stage anal years of toilet training bring conflicts regarding control and autonomy, which may lay the foundation for compulsively controlling neatness or rebellious disorderliness. Phallic stage occurs in preschool years and is characterized by the Oedipus complex, involving children's romantic attractions to the opposite-sex parent while being resentful toward same-sex one, resolved through identification with the same-sex parent. The latency period that occurs during middle childhood includes the sublimation of sexual desires to learning and socializing, while the genital stage entering puberty brings a mature life and love.

Although Freud's particular psychosexual parser psychological-con of therapy remain controversial and empirically questionable, the more general notion that early relational experiences critically shape psychological development is well rooted in empirical work (seeToates 1995; Shaver et al. The empirically based attachment theory of John Bowlby and Mary Ainsworth explains how early caregiver-child contrasts set "internal working models" for the self and others that shape future relationships and adaptation.

Attachment security, derived from responsiveness and sensitivity in caregiving, promotes a sense of self-confidence and well-being as well as the ability to form intimate relationships. Insecure attachment styles, such as anxious, avoidant and disorganized attachments, which develop out of a pattern of inconsistent or rejecting or even frightening, care-giving is correlated with maladaptive interpersonal behavior, emotional deregulation and psychological susceptibility. The teacher-student relationship is especially significant from a psychoanalytic viewpoint, as it may provoke infantile responses based on transfer which students direct toward teachers without their being aware of it, i.e., they use their earlier relationships as far back as infancy to replace feelings and things they missed due to the previous broken continuity. Pupils' attitudes towards their teachers Associations may not be based so much on the teacher's real qualities or performance but are often projected unconsciously from childhood experiences, adult vs. and responses to a parent who might somehow resemble the teacher concerned. Teachers may also experience countertransference, projecting their own issues and relationship patterns from the past onto students. Aptarian knowledge of these dynamics can assist educators in not mistakenly identifying students' reactions as hysterically disproportionate or inappropriate in response to present context and rather may represent earlier relational experiences. 61 The therapeutic concept of the “holding environment” an emotionally safe and supportive relational context that allows negative emotions yet balances support and limits, is a useful analogy in education to describe teachers’ emotional safety enabling students to take learning risks.

The role of anxiety generally in learning is complex according to psychoanalytic thought. Healthy anxiety, a moderate amount of concern and attention to doing well, can help students apply themselves and show up; overwhelming anxiety based on unconscious conflicts or early trauma intrudes into the cognitive spaciousness and memory that allows authentic learning and deepening. Test anxiety, fear of public speaking and learning blocks often have underlying emotional dynamics beyond that of the inability to prepare well or process information. Strong censure, undue pressure, or humiliating teaching techniques might stimulate defense systems that shield self-esteem at the expense of learning. Pupils might distance themselves from difficult

academic material carefully because it unconsciously threatens self-concept, or they might obsessively strive for flawlessness fueled by harsh internalized criticism that creates chronic stress and undermines inherent drive. Current psychoanalytic educators stress fostering emotionally safe learning contexts in which students can admit to confusion, error, or difficulty with challenging material without being shamed or overwhelmed by anxiety. The "good enough" teacher (cf good enough mother in object relations) contends that teachers need not be ideal but provide relationships that are generally responsive and accepting and recognize their own humanness and limitations. Hyper-responsible, perfectionist teachers end up duplicating dysfunctional relational patterns that undermine students' independence and self-assurance. In contrast, when teachers accept uncertainty and model how to confess errors, uphold limits while expressing concern in a caring manner they create relationship spaces that sustain the growth of cognitive and emotional experiences.

Play and the role of imagination enjoy a special position in psychoanalytic accounts of development and learning. Freud considered play to fulfill important psychological roles such as meeting wishes, relieving anxiety and dealing with the troubling life experiences. Anna Freud and Melanie Klein used play therapy methods to acknowledge the fact that children possessed symbolic play, representing them working through emotional problems. Early childhood educational apps outline the value of incorporating opportunities for creative expression, imaginative play and artistic production as vehicles of emotional exploration and identity construction beside academic acquisition. Through the creative arts, learners no longer view themselves as objects of their curriculum; they are active participants who are able to integrate learning of emotions with cognitive knowledge.

Sublimation, redirecting primitive drives into socially sanctioned endeavors: this is a psychoanalytic explanation for how fundamental motivational energies animate intellectual and artistic activities. Intellectual curiosity and the quest for control may be symbolized expressions of primitive curiosity/exploratory drives. Through artistic creation, scientific discovery, and scholarly achievement it is possible to express buried content in socially acceptable ways. This view implies that, rather than trying to stifle student energy, curiosity and assertiveness (as maintain chairs do), good education channels these forces into meaningful learning. "Concerning psychoanalytic perspectives in education, critics consider a number of limitations. The theories focus on the unconscious and early childhood experiences make it seem too deterministic, overlooking that people do have the potential to consciously change or develop resilience. In addition, psychoanalytic ideas are difficult to operationalize and test empirically, with some in the field questioning whether they are even scientific. Little attention is often given to normal development and benign motives. Historically constrained heteronormative assumptions about gender development and sexuality pervade classic psychoanalytic views, which need significant revision. Furthermore, the use of psychoanalytic insights necessitates nuance that few teachers possess in nongraded territory and amateur psychoanalysis of students runs the risk of misunderstanding and violation.

Yet psychoanalytic ideas, as will be discussed, offer important insights into the affective aspects of educational transaction that are all too frequently overlooked by cognitive-behavioral approaches. Recognizing that behavior is a signpost to deeper, often unconscious causes helps us to feel more compassion and looks in the right place for an analysis of learning difficulty. The acknowledgement of relationships in education highlights the relevance of relationships between teachers and students not only for effective teaching. Understanding the influence of anxiety and defense on learning promotes condition for affectively supportive classroom climates. Current integration of attachment theory, emotion regulation epistemology research and relational-cultural theory offer empirically informed contexts for using psychoanalytic knowledge in evidence-based educational practice.

4.2.5 Recent Models

Contemporary educational and psychological theory is constantly evolving and recent theoretical frameworks are increasingly drawing upon insights from neuroscience, technology, cross-cultural research and trans disciplinary

scholarship erecting more holistic accounts on learning and development. Such developing theoretical models overcome limitations of the older theories while retaining important aspects, leading to gradationally more complex representations of human learning processes in action. There have been a number of recent theoretical advances that have potentially important consequences for educational practice and our understanding of conditions for effective learning.

The theory of self-determination, a framework for the study of human motivation that goes beyond extrinsic intrinsic dichotomies was invented by Edward Deci and Richard Ryan. These are autonomy, the psychological need to experience behavior as self-determined versus controlled by external pressures; competence, the need to feel effective in producing desired outcomes and mastering challenging tasks, including the opportunity for achieving feedback about oneself; and relatedness, the need to feel connected with others in accepting and mutual interdependent ways. Background environments that support these three basic needs promote the quality of individuals' motivation, psychological well-being, and full psychological functioning, whereas those that thwart the satisfaction of these needs lead to a decrease in well-being and motivation. Educational games focus on opportunities to make choices that matter, optimal challenges, relationships of support and reasons for needed activities rather than simply using external rewards and punishment that undermine intrinsic motivation.

Self-determination theory makes a distinction between different types of extrinsic motivation that reflect degrees of self-determination. Regulation by external is acting in order to achieve rewards ore escape punishments and is the least autonomous form of extrinsic motivation. Introduced regulation refers to people that for some reason have internalized external demands, they do something in order not to feel guilty or shame or because of a sense of duty rather than out of interest. Integrated regulation implies that behavior is controlled by personally valued goals even when these are not inherently interesting. Integrated regulation, the highest degree of autonomous external motivation, is reached as individuals fully internalize identified values.

This spectrum acknowledges that there is considerable valuable learning that students might not initially find intrinsically motivating but can learn to value experientially through supportive educational experiences which then become internal events. Carol Dweck's theory of the growth mind-set examines how beliefs in skillfulness and talent influence motivation, persistence, and performance. People with fixed mindset have a (conscious or unconscious) belief that intelligence is an unchangeable, stable entity and therefore perceive challenges as possible tests of their limits they try to shy away from them and when challenged they give up easily, view effort as implying ability deficiency, think it is about luck, not 'not trying hard' on the part of others who do better than them (manifests in overly celebrating failures too). In contrast, individuals with a growth mindset believe that intelligence can be enhanced through effort and learning and who have a goal to achieve mastery." Such people they welcome challenges, persist in the face of failure, understand that effort is required for mastering anything and are motivated by the success of others. The research is clear that mindset can be changed through intervention, and that encouraging growth mindset enhances academic performance, especially for members of a group who are negatively stereotyped as being less able.

Educational interventions on growth mindset focus on such attention to the "details" of praise (focusing it on effort, strategies, and progress rather than innate talent), strategy use (using more opposed to fewer strategies), normalization of struggle and errors (they are a natural part of learning), teaching explicitly about brain plasticity and how challenge and practice make the brain grow, working with children to develop better responses when they experience failure. Yet new research on growth mindset is showing teaching students to believe in their potential just isn't enough (nor should it be) without offering structuralized pathways, genuinely supportive learning environments and adequate instruction and resources. Applicability and impact of the theory lee depends on the quality of implementation and contextual factors, as superficial applications can sometimes result in harmful messages that students who struggle aren't trying hard enough without genuine external impediments. Embodied cognition is a paradigm that questions the classic notion of thinking as abstract, symbolic manipulation solely occurring in the brain.

This viewpoint suggests that cognition is deeply rooted in bodily experiences and sensorimotor activities through which physical states, body movements, and behavioral responses to surrounding environments all conspire in molding human thought. Research shows that movement is as important in facilitating learning as the passive receipt of information, abstract thought depends on metaphorical correlates grounded in bodily experience, and cognition permeates beyond human skulls to include body and space. Implications for practice include teaching with attention to movement and gesture, realizing that manipulatives support children's learning through embodied cognition and not just concrete representation, and creating educational environments weighted by the spatial and physical dimensions of thinking.

Educational theory and practice are informed in ever-growing ways by the field of neuroscience, but such developmental models have to be used with care not translated into superficial pedagogical application. Studies of neuroplasticity show that experience influences brain anatomy and activity from infancy to old age, in favor of growth mindset principles, or belief in the malleability of intellectual ability. Studies on memory consolidation show that sleep is beneficial for learning, attention research demonstrates the costs of multitasking and benefits of sustained focus, reward processing studies indicate how different motivational types engage separate neural circuits. However, many so-called brain-based learning strategies are not well grounded in neuroscience, and the field needs to guard against an overreliance on neuroscience at the expense of solid educational research rather than rushing ahead first with tentative findings.

Technology-mediated learning models concern the fundamental changes in the character of learning opportunities, access to information and pedagogical options brought on by digital technologies. Instead of seeing technology as a vehicle for traditional content, modern educational paradigms have acknowledged its capacity to introduce new forms of interaction, representation, collaboration and assessment. The TPACK framework highlights that successful technology integration involves the capacity to perceive intricate relationships among the affordances of technology,

pedagogical approaches and nature of content. Personalized learning models use technology to provide customized instruction based on learners' needs, pace, and interests, but challenges around equity, data privacy, maintaining personal connections remain significant. Culturally responsive pedagogy and funds of knowledge approaches recognize that learning always occurs in cultures, and so honours the valuable cultures students come ready equipped with, rather than ignore or devalue them. These frameworks contest those deficit beliefs that represent students' cultural differences as deficits in need of remediation. Rather, they call for teachers to recognize and add value to the cultural resources students bring from their communities, experienced lives in-and-out of school and their language capacities. Teachers come to understand students' communities and families, acknowledge varying ways of knowing within them, foster inclusive learning environments in which all students find themselves reflected (see "I Am" Statements), and challenge the power dynamics that structure learning experiences and outcomes.

21st century learning Frameworks seek to define the competencies students will likely need for success in today's rapidly changing, interconnected, and knowledge-based world. These structures' focus on critical thinking, creativity, collaboration and communication, the "four Cs," of course usually also include digital literacy, cultural competency and self-directed learning. While these frameworks consider key competencies, some critics argue that they are constructed from privileged perspectives, can underestimate the power of disciplinary expertise and the basics of schooling, and can reflect corporate interests in education as means to serve economic goals rather than advancing broader human development and democratic citizenship. However, they add that education must equip students for uncertain futures which will demand flexibility, complex problem-solving and lifelong learning rather than simply transmitting fixed knowledge.

Applications of positive psychology in educational settings emphasize on strengths, wellness and highest potential for human being instead of just looking at problems and deficit. Character strengths education enables students to recognise and cultivate their own character strengths, such as curiosity,

perseverance, kindness and leadership. Well-being programs target different facets such as positive emotion, engagement, relationships, meaning and accomplishment. Practices of gratitude, mindfulness training, and social-emotional learning curricula target psychological resilience and life satisfaction as well as academic outcomes. There is some initial empirical evidence in support of a number of these methods; however, questions remain regarding how best to balance well-being and academic aims and whether such programs are addressing the structural issues driving student wellness.

Theories of complex systems and dynamic system offer a framework for conceiving development and learning as emergent, non-linear processes that result from the interplay between multiple components operating at distinct timescales, across levels of organization. These formulations resist linear stage theories and simple X ® Y causality models, recognizing that small differences can have large outcomes, the effects depend on initial conditions and context, and development occurs as periods of stability intercalated with rapid shifts. Implications for education are that variability and individual differences must be considered, learning trajectories will not be uniform, the classroom is viewed as a complex adaptive system and educational change occurs due to systemic factors and resists simple interventions.

New theoretical work is more and more focus on the interconnected multidisciplinary approach rather than sticking to one of these theoretical orthodoxies. The Cedar song Nature School, influences on young children's connections with the natural world The implications of these complementary theoretical ideas are beginning to be recognized and incorporate different aspects of the full, multifaceted phenomena of human learning and development as well as their biology (which from a complex system perspective changes on a slow timescale), cognition, emotion, social systems, culture. Good teaching uses a variety of theories and selects instructional strategies based on learning objectives, the content being taught, the developmental status of the learners, and individual student needs. The most useful path for educational theory is the ongoing development, empirical validation, and consideration of diverse metaphors that add depth to

our understanding of how humans learn over a lifespan.

Instructional Design Models: The Ultimate List

Instructional design is defined as a systematic method of making instruction more effective and efficient. So instructional design is, at its heart, a blend of art and science: applying learning theory to the challenge of developing learning experiences that enable learners to meet designated learning outcomes.The field has changed substantially in the last few decades, resulting in several models and frameworks that inform the practice of educators, trainers and instructional designers. These models offer organized means of addressing learning needs, designing relevant interventions, then constructing teaching materials, initiating programs and assessing outcomes. All models have different perspectives and approaches but all are aimed at improving learning by planning how to effectively teach. It is important to know these basic models for anyone interested in teaching, corporate training and really anything were knowledge transfer is critical. This brief overview will take a look at four of the most afford instructional design models: The ADDIE Model, ASSURE Model, Dick and Carey Model and Gagne's Nine Events of Instruction; all contributing unique perspectives and resources for the instructional design process.

The ADDIE Model: Core of Instructional Design

The ADDIE Model is one of the most well-known and frequently used instructional design models, which serves as a strong foundation for even novice designers in the education and training industry globally. The ADDIE model [3] is an acronym representing five steps of the Instructional Design (ID) phase: Analysis, Design, Development, Implementation and Evaluation. This model resulted as an attempt to have a disciplined and systematic way of developing effective teaching/learning experiences, the enduring usefulne90sB1TSS of this concept is attributed to its nature in terms of logical construction flexibility and adaptability across different educational settings. The ADDIE Model is both process and product, serving as a guide for creating instruction and, at the same time, generating content that can be used as learning objects.

What sets ADDIE apart from most linear design procedures, however, is that it's iterative good instruction design doesn't follow a strictly sequential model but rather involves regular revision and adaptation based on feedback and evaluation data gathered throughout the process.

Analysis Phase: Laying the Groundwork

Phase is the core of all subsequent instructional design work. In this first phase of design, designers carry out an extensive analysis of the learning environment and problem, seeking to understand the gap between current performance and desired performance and whether instruction seems to be a feasible solution. This is authentic analysis, where multiple factors are taken into account, not least a needs analysis to determine what learners need to know and be able to do at the end of the learning compared with what they already know and can do. For one, 'effective instruction is based on what people already know at the time yo u are teaching them'; therefore designers analyze learners to render explicit who their clients (learners) are and what is known about them in order to fit the instruction to he learner. Environmental analysis looks at the situation in which learning is to take place and considers what resources are available, how much technology is held in the organization, time limits etc. Task analysis deconstructs complex skills or knowledge domains into sub skills and sub knowledge, which allows one to identify the particular competencies that learners need to acquire. The Analysis stage also includes determining the constraints and resources that may affect design decisions such as budget and access to subject matter experts. A deep diving of the learning challenge and context enables designers to ensure that follow-on phases are based on a solid interpretation, avoiding the common mistake of making solutions in search of a problem without consideration for real learner needs.

Design Phase: Creating the Blueprint

The Design phase transforms the analysis into an instructional blueprint on which all development is based. In this stage, instructional designers make important decisions regarding learning objectives, assessment methods, types of instructions and media selection. Clear, measureable learning objectives are perhaps the most important design activity because they describe specifically what learners will need to know or be able to do when they have finished instruction. Capable objectives build on accepted formats like Bloom's Taxonomy to provide the appropriate cognitive complexity as well reflecting what is intended. Designers also create assessment methods which are linked directly to learning objectives, defining how they will decide whether learners have accomplished their goals. This entails the development of both formative assessments to assess progress during instruction, and summative assessments to measure final achievement. Making design decisions for sequencing also falls under the Design phase – deciding when to present materials and activities in lessons that is inspired by theories of learning psychology and instructional strategy. Designers are able to identify appropriate instruction strategies (e.g. direct instructional, discovery learning, problem-based leaning or collaborative learning) based on the material nature, learner's characteristics and goals of instruction. Decisions here include what media types to employ, based on learning objectives, learner preferences, content needs and available resources. At the end of the Design phase stands a detailed design document which is used as a detailed specification for developers and guarantees that everything follows does not deviate from how it should be through the development process.

Stage Two: Constructing the Learning Experience

The Design stage takes the design specifications and turns them into actual instructional materials and a learning experience. This is the costliest phase of ADDIE in which all parts, pieces, and content for the final learning experience are developed. The nature and extent of development activities can differ quite substantially; writing simple text-based materials and developing multimedia-rich content, interactive simulations or VR solutions is all covered. On one hand, IDers work with specialists to make sure the material is factually accurate and complete; and on the other side they team up with media specialists, graphic artists, computer programmers, and other technies to produce professional-caliber instructional materials. Development The Development stage occurs in repetitive cycles of authoring and revising: prototypes and drafts are revised multiple times on the basis of feedback provided by stakeholders, content experts, and frequently also sample learners.

During this phase, the quality assurance process ensures that all content works as intended, contains accurate information and complies with design standards and accessibility concerns. Developers need to produce (and develop) ancillary materials, such as facilitation guides for instructors, handouts for learners, job aids and technical systems documentation. Things like version control and project management take on high levels of importance in the Development phase, especially as components need to synchronize amongst multiple tracts at more complex projects with more team members.

The Robert Gagné's Model

Robert Gagné's Nine Events of Instruction is a foundational model in instructional design, providing a structured approach to organizing learning experiences. Originally outlined in 1965, it offers practical strategies to enhance learning outcomes. Available as a free PDF resource, this model remains widely used in both traditional and online educational settings, emphasizing clear objectives and learner engagement. Its relevance continues to grow in digital learning environments, making it a cornerstone for educators and instructional designers worldwide.

Overview of the Model

Gagne's Nine Events of Instruction is a systematic framework designed to guide instructional designers in creating effective learning experiences. Developed by Robert M. Gagne's the model outlines nine sequential steps to ensure learners achieve specific learning objectives. These events include gaining attention, informing learners of objectives, stimulating prior learning, presenting content, providing guidance, eliciting performance, offering feedback, assessing outcomes, and enhancing retention. The model emphasizes the importance of clear structure and alignment between objectives and activities. Widely used in both traditional and online learning environments, it offers a practical approach to organizing instruction. Available in PDF formats, resources like "Gagne's Nine Events of Instruction" provide detailed explanations and templates for implementation. This framework remains a cornerstone in instructional design, helping educators and designers create engaging and goal-oriented learning experiences for diverse audiences.

Importance in Instructional Design

Gagne's Nine Events of Instruction holds significant importance in instructional design by providing a structured approach to creating effective learning experiences. Its sequential framework ensures that learning objectives are clearly defined and systematically achieved. The model emphasizes the alignment of instructional strategies with desired outcomes, enhancing both the efficiency and effectiveness of teaching. By guiding educators to engage learners actively, it fosters deeper understanding and retention. The availability of resources like "Gagné's Nine Events of Instruction" in PDF formats makes it accessible for designers to implement these principles across various settings. This model is particularly valuable in online learning, where clear structure and engagement are crucial. Its adaptability and practicality make it a cornerstone in modern instructional design, ensuring that learning experiences are both meaningful and impactful for diverse audiences.

ASSURE instructional design model

It is an instructional design model that has the goal of producing more effective teaching and learning. “ASSURE” is an acronym that stands for the various steps in the model. The following is a breakdown of each step.

Figure 4.5: ASSURE instructional design model

A – Analyze Learners

The first step in the process is that the teacher should analyze the attributes of her learners. There should be a focus on those learner characteristics which are associated with the learning outcomes desired. The information gathered will help you in the decisions that you make with respect to the other steps in the process. When you determine the character of the learners, it will guide you in choosing specific strategies and resources to aid the learning process.
The analysis of your learners should include:

- The general attributes of your learners, such as age, academic abilities, gender, interests, etc.
- Prior competencies
- Learning styles, such as auditory, visual, and tactile

S – State Standards and Objectives

After the analysis of the learner attributes, the teacher must state standards and objectives for the learning module. This statement consists of a specification of what the learners will be able to do as a result of the instruction.

To be more concrete about things, this statement will focus on what the learner will know or be able to do as a result of the instruction. An example of this is with medical students. The learners will be able to name at least two databases and two search techniques that they can use to locate medical evidence for particular cases.

The objectives can be used in assessing the success of the students, perhaps for the grading process. Also, you can use them to let the learners know what they will accomplish through the class.

The mark of a good set of learning objectives is conformity to the ABCDs of well-stated learning objectives. They are as follows:

- Audience – For whom is the objective intended?
- Behavior – What is the behavior or performance to be demonstrated?
- Conditions – What are the conditions under which the behavior or performance will be observed?
- Degree – To what degree will the knowledge or skill be mastered?

The objectives statement should be formulated with verbs that pinpoint the learning objective. A useful guide to the appropriate verbs to use is contained in Bloom's Taxonomy. Remember that assessment can only be based on your learners' behavior. A learner may know some material backwards and forwards but may not be able to perform well on a test.

S – Select Strategies, Technology, Media, and Materials

The second "s" in the acronym stands for select strategies, technology, media, and materials. Given what your learning objectives are, it's necessary to pick instructional strategies, technology, and media that will bring about the results that you want.

First, you should figure out what which delivery method will be best for your instruction. For instance, what proportion of your instruction will be instructor-centered and what proportion of will be student-centered? The first of these are strategies such as lecture, demonstration or showing a video. The second are strategies such as group discussion or cooperative group work.

Common sense weighs in on the side of learner-centered strategies. Learning becomes more exciting when there is more class participation. Ultimately, it's the learner who must gain mastery over the material, not the teacher. However, there will be a certain amount of crucial information and technique that the teacher must give over and demonstrate.

Learning is at its best when the teacher merely leads the student into discovering the correct answer to a problem themselves. An effective teacher is merely a facilitator to the process of learning.

Once you select your teaching strategy, then it's time to figure out which technology, media, and materials best support the method of teaching that you're using. This ranges from simple tools such as chalk and blackboard to more sophisticated ones such as power-point presentations. What must be remembered is that the instructor is the essential ingredient in giving over the material. Fancy tools are useful, but it ultimately boils down to having someone who knows more than what the textbook contains.

U – Utilize Technology, Media, and Materials

This step in the ASSURE process concerns making a plan as to how you will utilize the technology, media, and materials that you have selected. As with all of the instructional steps, you must make sure that your plans contribute towards producing the objectives that you have laid down.

It's important to follow the "five p's" process to achieve this:

Preview the Technology, Media, and Materials

This means that it's important to plan ahead of time just how you're going to use them. It's good to do a dry run of your lesson before you actually teach it. Make sure that the whole lesson will go smoothly and seamlessly.

Prepare the Technology, Media, and Materials

You need to gather together all of the things that you will need to teach your lesson. They must be working properly. For example, if you are making a power-point presentation, then you'll need to create the text and graphics for each screen.

Prepare the Environment

There is some minimal preparation required to set up the learning environment. Simple things like making sure that you have enough desks are important. Also, if you have control over the situation, you should make sure that there are no sources of noise that will disturb the students.

Prepare the Learners

First, you need to clearly inform the learners as to what the learning objectives are. This will help the learners create a mental map of what they need to absorb. Next, it's important to tell the students how they will be assessed. You need to tell them what their assignments will be, how they will be graded, if there are tests, etc. Also, you should explain to the students what the benefits of learning the material are.

Provide the Learning Experience

You then actually carry out the lesson. This is where all of your planning takes effect. You should be prepared to carry out the lesson with every prior step of the process in mind. This will insure your success as a teacher.

R – Require Learner Participation

This step actually belongs within earlier steps. It requires that you make plans to how you are going to actively engage your students in the material that you are teaching. This needs to be figured out both at the class level and the individual level.

The most basic step that you can take is requiring participation of the students in class discussions. A more sophisticated approach would require that students prepare questions and comments at home to bring into the class. You might try even allowing individual students to lead classes or discussions in the style of a seminar.

Beyond this, you need to plan exactly how the students will participate in the learning process generally speaking. How will they learn the information and techniques included in a lesson? This plan needs to be more specific than just saying that they will listen and absorb the material. Maybe you will encourage a specific kind of note-taking or other learning strategies.

E – Evaluate and Revise

The final step in the ASSURE process is just as crucial as all of the others. In this step, you evaluate the impact of your teaching on student learning. This includes an evaluation of your teaching strategies and the technology, media, and materials that you used. The following questions are useful to ask during this evaluation:

- Did your lesson meet the learning objectives that you planned? How will you determine whether the students reach the objectives? Is your way of assessing the students in line with your learning objectives?
- Can this lesson be improved? How? How are you going to assess the weaknesses in your presentation?
- Was your choice of media and materials a good one? How will you assess the effectiveness of these tools?
- Is it possible that other technologies, media, and materials would have done a better job?

The final step in your evaluation should focus on feedback from your students. Was their experience positive overall? Do they feel that they have reached your objectives and their own personal objectives? How will you determine whether or not your performance was effective?

Dick and Carey Model of Design

Introduction

The Dick and Carey Model was introduced in The Systematic Design of Instruction (1978) by Walter Dick and Lou Carey. This model presents instructional design from a systems perspective, emphasizing that instruction should be viewed as an interconnected process rather than a collection of separate components. Similar to the Kemp Model, it highlights the interrelationships among key elements such as context, content, learning, and instruction. According to Dick and Carey, the instructor, learners, materials, instructional activities, delivery systems, and learning outcomes all interact cohesively to achieve the desired educational goals. As illustrated in the model, its components are implemented both iteratively and simultaneously, ensuring a continuous and integrated design process.

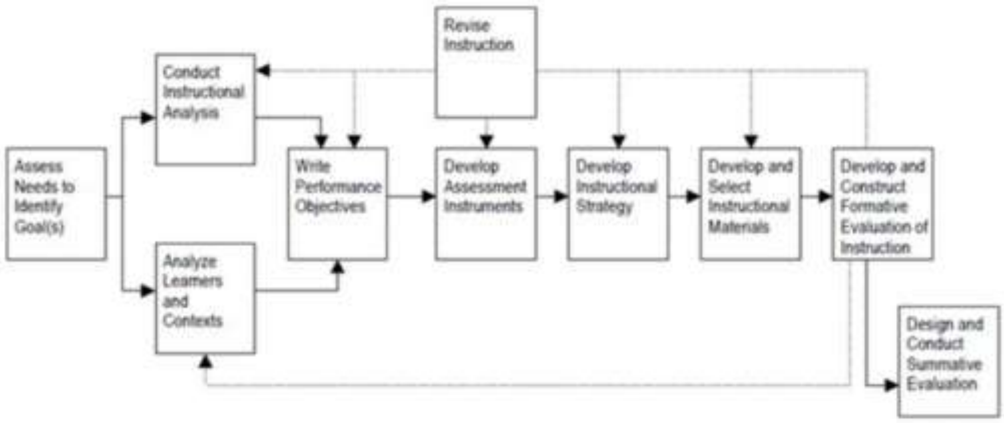


Figure 4.6: Dick and Carey instructional design model

Components of the Dick and Carey Model

- Identify the instructional goals- the skills, knowledge, and/or attitude that a learner will be expected to acquire.
- Conduct instructional analysis – identify what a learner must recall to perform a particular task.
- Analyze learners and contexts- what are the general characteristics of the learners including prior knowledge and skills need to meet the objectives.
- Performance objectives- writing an objective for the learner consists of three parts: the behavior, the condition, and the degree. Objectives must be measurable in order to accurately assess the performance.
- Develop the assessment tools- types of tests could pre-test-post-test, practice items, etc.
- Develop instructional strategies- pre-instruction activities, content presentation, participations and assessment.
- Develop and select instructional materials.

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- Design and conduct formative evaluation of instruction-identify areas of the instructional materials that are in need of improvement.
- Revise instruction based on poor test items and/or poor or unsuccessful instruction methods.
- Design and conduct summative evaluation.

Gagne's Nine Events of Instruction

Gagne's Nine Events of Instruction is a widely recognized framework for designing effective learning experiences. It outlines nine sequential steps to guide learners from initial engagement to final assessment. Available as a free PDF resource, this model provides clear strategies for instructional designers to create structured and engaging lessons. Its systematic approach ensures that learning objectives are met efficiently, making it a valuable tool for educators and trainers across various disciplines.

Gain Attention

Gaining attention is the first and foundational step in Gagné's Nine Events of Instruction. This step aims to capture learners' interest and ensure they are mentally prepared to engage with the material. Techniques such as thought-provoking questions, multimedia elements, or real-life scenarios can be effective. The goal is to create a stimulus that shifts the learner's focus to the lesson. In online learning environments, this can be achieved through interactive elements like videos, animations, or gamification. By grabbing attention, instructors set the stage for active participation and better retention of information. This step is crucial as it helps prevent cognitive overload and ensures learners are receptive to the upcoming content. A well-designed attention-grabbing activity can significantly enhance the overall learning experience.

Inform Learners of the Objective

Informing learners of the objective is the second step in Gagné's model, ensuring clarity and focus. This step outlines what learners will achieve by the end of the lesson, providing a clear direction. Objectives should be specific, measurable, and aligned with the learning outcomes. Instructors can communicate these objectives through statements, bullet points, or interactive elements. By sharing the objectives upfront, learners understand what is expected of them and can better organize their efforts. This step also helps reduce confusion and ensures learners remain motivated. In online environments, objectives can be presented through introductory screens, videos, or downloadable PDF resources. Clear communication of objectives enhances engagement and helps learners track their progress. This step is essential for creating a purposeful and goal-oriented learning experience.

Stimulate Recall of Prior Learning

Stimulating recall of prior learning is the third step in Gagné's model, designed to activate learners' existing knowledge and skills. This step helps learners connect new information to what they already know, making learning more meaningful. Techniques include discussions, quizzes, or activities that revisit previous content. By recalling prior learning, learners build a foundation for new concepts and reduce cognitive overload. This step is particularly effective in online environments, where interactive elements like pop-up questions or reflective exercises can engage learners. PDF resources often include examples of how to implement this step, such as through icebreakers or quick reviews. Stimulating recall ensures that learners are mentally prepared to absorb new information and makes the learning process more efficient and effective. It bridges the gap between past and new knowledge, enhancing retention and understanding.

Present the Content

Presenting the content is the fourth step in Gagné's Nine Events of Instruction, focusing on delivering the instructional material effectively. This step ensures that learners receive clear, well-organized information tailored to their needs. Instructional designers use various methods to present content, such as lectures, videos, or readings. The content should be structured logically, with key points highlighted to enhance understanding. Visual aids, examples, and demonstrations are often employed to make the material engaging and accessible. PDF resources on Gagné's model emphasize the importance of clarity and conciseness in presentation to avoid overwhelming learners. By presenting content in a systematic and learner-friendly manner, educators can facilitate better comprehension and retention of the material. This step is crucial for aligning the instruction with the previously stated objectives and building on the recall of prior learning.

Provide Learning Guidance

Providing learning guidance is the fifth event in Gagné's model, focusing on supporting learners as they engage with the content. This step involves offering clear explanations, examples, and demonstrations to help learners understand and apply the material; Guidance can take many forms, such as written instructions, audio narration, or interactive elements in digital learning environments. The goal is to reduce confusion and ensure learners can connect new information to their existing knowledge. According to Gagné's Nine Events of Instruction PDF resources, effective guidance promotes active learning and helps learners achieve the stated objectives. By providing structured support, educators can address diverse learning needs and facilitate deeper understanding of the content.

Elicit Performance (Practice)

Eliciting performance, or practice, is a critical step in Gagné's model, allowing learners to apply what they have learned. This phase involves active engagement, where learners demonstrate their understanding through tasks, exercises, or simulations. Practice activities are designed to bridge the gap between learning and real-world application, ensuring that learners can transfer their knowledge effectively. According to Gagné's Nine Events of Instruction PDF, this step is essential for reinforcing learning and identifying areas where additional support may be needed. By providing opportunities for practice, educators can help learners build confidence and competence, preparing them for future challenges. Immediate feedback during this phase further enhances the learning process, guiding learners toward mastery of the objectives.

Provide Feedback

Providing feedback is a pivotal step in Gagné's Nine Events of Instruction, serving as a direct response to the learner's performance. This phase ensures learners understand their progress and identifies areas needing improvement. Feedback can be immediate or delayed, depending on the learning context. According to Gagné's model, effective feedback should be specific, clear, and constructive, guiding learners toward achieving the desired outcomes. It also helps instructors assess whether the learning objectives are being met. By linking feedback to the learner's performance, educators can reinforce correct behaviors and address misconceptions promptly. This step is crucial for fostering a supportive learning environment and enhancing overall learning effectiveness. Gagné's Nine Events of Instruction PDF emphasizes the importance of timely and meaningful feedback in promoting successful learning experiences.

Assess Performance

Assessing performance is a critical step in Gagné's Nine Events of Instruction, allowing instructors to evaluate whether learners have achieved the defined objectives. This phase involves measuring the learners' mastery of the content through various methods, such as quizzes, exams, or practical tasks. The assessment provides insight into the effectiveness of the instructional strategies and identifies any gaps in learning. By comparing the learners' performance to the stated goals, educators can determine the success of the instruction. This step also helps in documenting learner progress and informing future instructional decisions. Gagné's model emphasizes the importance of objective assessment to ensure learners are adequately prepared to apply their knowledge in real-world situations. This phase is essential for validating the instructional design and making necessary adjustments to improve learning outcomes. The assessment data serves as a valuable tool for both learners and educators.

Enhance Retention and Transfer

Enhancing retention and transfer is the final step in Gagné's Nine Events of Instruction, focusing on reinforcing learning and ensuring its practical application. This phase involves summarizing key content, providing additional resources, and encouraging learners to apply their knowledge in real-world scenarios. Strategies such as job aids, performance support tools, and reflective exercises are commonly used to facilitate retention. Transfer of learning is promoted through opportunities for practice and feedback, helping learners connect new skills to their work environments. This step ensures that the instruction has long-term benefits, making it more likely for learners to retain and effectively use the information. By reinforcing learning outcomes, this phase bridges the gap between training and on-the-job performance, maximizing the impact of the instructional design. Effective retention and transfer strategies are essential for achieving the ultimate goal of Gagné's model: meaningful and lasting learning.

Application in Online Learning Environments

Gagné's Nine Events of Instruction are adaptable to online learning, enhancing engagement through multimedia and interactive content. PDF resources provide templates and examples for e-learning design, ensuring effective skill transfer and learner motivation.

Adaptation of the Model for Digital Platforms

The adaptation of Gagné's Nine Events of Instruction for digital platforms involves integrating multimedia and interactive elements to enhance engagement. For instance, gaining attention can be achieved through videos or gamification. Presenting content can leverage animations and simulations, while providing feedback can be automated. The model's structured approach aligns well with online learning, where self-paced modules can incorporate quizzes and discussions. PDF resources, such as the Gagné Nine Events Example and Template1, offer practical tools for designing these experiences. By tailoring each event to digital formats, educators ensure active participation and effective knowledge transfer. This adaptation not only modernizes the model but also expands its accessibility, making it a versatile framework for 21st-century learning environments.

Benefits of the Model in E-Learning

Gagné's Nine Events of Instruction offers significant benefits in e-learning by providing a clear, structured framework that enhances learner engagement and understanding. The model's emphasis on gaining attention, informing objectives, and stimulating prior knowledge ensures learners are actively involved from the start. In digital environments, the model supports personalized learning through interactive elements like quizzes, simulations, and real-time feedback. Its focus on clear objectives and measurable outcomes aligns well with e-learning platforms, where tracking progress is essential. Additionally, the model's adaptability to multimedia formats, such as videos and animations, makes complex content more accessible and engaging. By integrating these elements, Gagné's model helps ensure learners achieve their goals effectively, making it a valuable tool for modern e-learning designs.

Gagné's Nine Events of Instruction remains a cornerstone of instructional design, offering a systematic approach to creating effective learning experiences. Its relevance extends across various educational settings, including e-learning, where its structured framework enhances engagement and outcomes. By focusing on clear objectives, active participation, and feedback, the model ensures learners achieve their goals. The availability of resources like the Gagné's Nine Events of Instruction PDF further supports educators in applying these principles. As education evolves, this model continues to adapt, proving its timeless value in fostering meaningful learning. Its practicality and adaptability make it an essential tool for designing impactful instructional strategies in both traditional and digital environments.

4.3 Self-Assessment Questions

4.3.1 Multiple Choice Questions (MCQs)

1. **The elements of a communication system include:**

   a) Only sender and receiver

   b) Sender, message, channel, receiver, feedback, and noise

   c) Teacher and students exclusively

   d) Verbal communication only

2. **Which of the following is a type of communication?**

   a) Verbal communication only

   b) Non-verbal communication only

   c) Verbal, non-verbal, written, and visual communication

   d) Digital communication exclusively

3. **Barriers to communication in classrooms include:**

   a) Effective feedback mechanisms

   b) Physical, psychological, semantic, and cultural barriers

   c) Clear message transmission

   d) Active listening

4. **Behaviorist learning theory in instructional design emphasizes:**

   a) Internal mental processes

   b) Stimulus-response and reinforcement

   c) Social context exclusively

   d) Unconscious motivations

5. **Social cognitive theory focuses on:**

   a) Isolated individual learning only

   b) Modeling and observational learning

   c) Punishment and rewards exclusively

   d) Passive reception of information

6. **Constructivist instructional design involves:**

   a) Passive listening to lectures

   b) Active learning and scaffolding

   c) Rote memorization

   d) Teacher-centered instruction only

7. **The ADDIE model stands for:**

   a) Analyze, Develop, Design, Implement, Examine

   b) Analysis, Design, Development, Implementation, Evaluation

   c) Assess, Design, Deploy, Instruct, Evaluate

   d) Apply, Design, Deliver, Implement, Execute

8. **The ASSURE model begins with:**

   a) Selecting media

   b) Stating objectives

   c) Analyzing learners

   d) Evaluating outcomes

9. **Gagne's Nine Events of Instruction begins with:**

   a) Assessment

   b) Gaining attention

   c) Practice activities

   d) Providing feedback

10. **The Dick & Carey Model is characterized by:**

    a) Random approach to design

    b) Systematic approach to instructional design

    c) Focus only on evaluation

    d) Elimination of learner analysis

4.3.2 Short Answer Questions

1. Define a communication system and list its essential elements.
2. What are the major types of communication? Explain with examples.
3. Describe any three barriers to effective classroom communication.
4. How does behaviorist learning theory influence instructional design?
5. Briefly explain the ADDIE model of instructional design.

4.3.3 Long Answer Questions

1. Discuss the concept and elements of a communication system. Explain how effective communication can be achieved in educational settings.

2. Describe the classroom communication model. What are the barriers to communication, and how can teachers overcome them?
3. Compare and contrast instructional design approaches based on behaviorist, social cognitive, constructivist, and psychoanalytic learning theories.
4. Elaborate on the ADDIE model of instructional design. Discuss each phase in detail and explain how this model ensures effective instruction.
5. Discuss recent trends in instructional design models: ASSURE, Dick & Carey, and Gagne's Nine Events. Compare these models and analyze their practical applications in educational contexts.

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