

THE FUTURE OF LEARNING

A REPORT BY ATOMCAMP

atomcamp

APRIL 2023

About Us

atomcamp is a continuous learning platform that is helping the youth and organizations unlock opportunities with Data Science.

atomcamp hosts various courses and programs centered on tech education to upskill the Pakistani workforce and to create the awareness that continuous education is critical to keep up with the fast-paced world.

Data Science Bootcamps

At atomcamp, we offer a variety of multidisciplinary courses, but our main focus is Data Science, Artificial Intelligence and Cloud Computing and Infrastructure, which are relatively new and emerging fields, especially in Pakistan. Our goal is to make careers in these fields accessible to everyone in Pakistan - regardless of the educational or professional background.

atomcamp's 6-month Data Science Bootcamp enables participants to learn relevant data skills and launch their careers. The program is meant for those who are aiming to switch into a data science career as well as those who want to incorporate data science training into their current jobs/careers to remain competitive.

Our 3-month AI bootcamp is designed to train you to launch your career in AI, regardless of the educational background. This program is designed for everyone as the first two months of AI bootcamp focus on building a foundation in Python, Math, and Machine Learning.

About the Author

This report has been authored by Aamna Babar and co-authored by Mahnoor Imran.

atomcamp

Our Mission



promote a culture of continuous learning



provide skill development for youth



encourage interdisciplinary learning



build learning communities



provide contextual & accessible knowledge

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Learning Statistics



88,071

higher education
institutions active in
2018



1.6 billion

learners were
affected in COVID-
19(2)



20-100 %

growth of Ed -Tech
startup users 2020 to
2022(3)



\$166.60 bn

from online education by
the end of 2023(4)

Learning is the lasting change in human behavior that is acquired through knowledge, skills, and experience. It is an on-going process that takes place throughout life and is not confined to the classroom. A learner is someone who is willing to explore and understand diverse concepts and ideas. They continually push their boundaries to see the world differently.

The Future of Learning: An Introduction

Traditional learning evolved after the industrial revolution in the 18th century. Traditional learning is based in an in-person, classroom setting with a moderator who regulates the flow of information. But in the 21st century, the integration of technology with education accelerated when traditional mediums of learning disrupted due to factors like lockdowns and school closures in COVID-19. These hurdles affected nearly 1.6 billion learners in more than 190 countries⁽¹⁾. To adapt with changing circumstances, online learning surfaced as part of the adaptation process and learning took a new shape. 87% of students today use digital learning materials at home⁽²⁾. Technologies like the Artificial Intelligence and ChatGPT played a significant role in transforming the educational experience.

Thereafter, EdTech startups have reported a 20 to 100 percent growth in users during 2020 to 2022⁽³⁾. Even the revenue from online education streams is projected to reach US\$166.60bn by the end of 2023⁽⁴⁾. Keeping this in perspective, the future of learning seems bright involving the shift from pressure on educational infrastructure to sustainability of online learning; and stability in one educational field to mobility of ideas in multiple disciplines⁽⁵⁾. This report presents an overview of the future of learning by assessing the growing role of technology in online and face to face learning. By the end of this decade, the education sector would have transformed in a multitude of ways through nanobots, teacher robots, and neuralink.

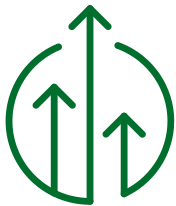
Driving Changes in Learning

The technological revolution taking place today is set to remodel learning in the future. This change has not come suddenly but with gradual scientific advancements due to the changing needs of society at large. The following factors played a significant role in transforming the dynamics of education.



Advances in Research

Breakthroughs in scientific research often lead to the development of new technologies enhancing learning. The invention of the 3D printer and its use in STEM projects for students to make prototypes is one of the many examples. Moreover, the availability of online platforms like Google Meet, Zoom, Microsoft Teams, etc. have also transformed the education system.



Growing Competition

Today, international borders have become more porous due to the internet and globalization that has resulted in greater awareness and knowledge exchange across studies. Such awareness has created competition inspiring learners at local and international stages. Some examples are the Clean Tech Competition, Marine Advanced Technology Education (MATE), and First Robotics Competition.



Technological Convergence

The integration of different technologies in working and non-working life has created a job market that focuses on technology and specialization. Technology is fast changing and ever-evolving today. As a result, learners not only have to be digitally literate but they must also be geared towards updating and upskilling with respect to the latest technological innovations.

Learning in the 21st Century

Learning today has transformed in multitude of ways. In a fast changing world, the education system has adopted new ways of learning and teaching. Following are the 3 emerging dimensions to learning in the 21st century;

1. Critical thinking in the age of information
2. Technological influence on different studies, and
3. The skills in demand by 2030

1. Critical Thinking in the Age of Information

Critical thinking is the process of actively conceptualizing, analyzing, and evaluating information gathered by observation, experience, and, reasoning as a guide to belief and action. It gives people the ability to distinguish reliable information from falsification– an essential skill in today's increasingly digitalized world. With information easily available and accessible on the web today, it is important for digital consumers to be able to know what to believe and what not to.

Knowing how to evaluate media helps students think more critically and determine the accuracy of information. With media literacy, they will verify the source of information first and cross-check the data to ensure its validity, effectively improving their judgment. Thus, developing critical thinking skills of students from an early age has become an important aspect of learning in the 21st century.

2. Technological Influence on Various Disciplines

In the traditional fields of engineering, medicine, and social sciences, technology is making a new space having major influence over these disciplines. Technology has captured a diverse range of areas under its influence and is thriving to make them efficient and more productive.

Even traditional fields thought to be far removed from technology have been transformed. Computer vision for example, which trains artificial intelligence models to detect medical anomalies through scans and pictures of patients has the potential to completely disrupt the diagnosis process in healthcare⁽⁶⁾.

What such a proliferation of technology means is that the application of technology to each specific field is an increasingly important part of education and learning for present and future learners. To successfully maneuver their careers and future pursuits, learners, regardless of their subject of study, must be well versed in the use of technology.

Technology Education in...

Digital Arts

With the internet becoming key source for the consumption and viewing of art, learning to create digital art has become a subset of the arts education. Adobe Photoshop and Art Studio are just some of the tools being taught to young students of elementary school as part of arts education⁽⁷⁾. Digital arts landscape transformed when OpenAI introduced DALL-E in 2021: a deep learning model that generates digital images from natural language descriptions.

Today, higher education institutions are also offering full time degrees at the intersection of Arts and Technology such as the University of Oregon, Stanford, and MIT ⁽⁸⁾.

Data Science & Public Policy

Today, governments and think tanks are working with large volumes of data to understand the sustainability of service delivery models. As a result, training in data for public servants has become the need of the hour⁽⁹⁾.

Public policy programs around the world offer-if not require-students to take courses at the intersection of data and policy-with some offering double degree in data management. Prestigious institutions like the London School of Economics and Oxford University offered dedicated programs in data science⁽¹⁰⁾.

Business Analytics

Data science and analytics are coming to the forefront of decisions about strategy, marketing and operations. Basic data literacy has become a critical cornerstone of a holistic business education. Fields such as business analytics provide a business centric approach to data science and AI. The latest version of ChatGPT can write codes and analyze data in a matter of seconds making business analysis even better.

As per the Harvard Business Review, business schools have launched more than 400 business analytics programs⁽¹¹⁾.

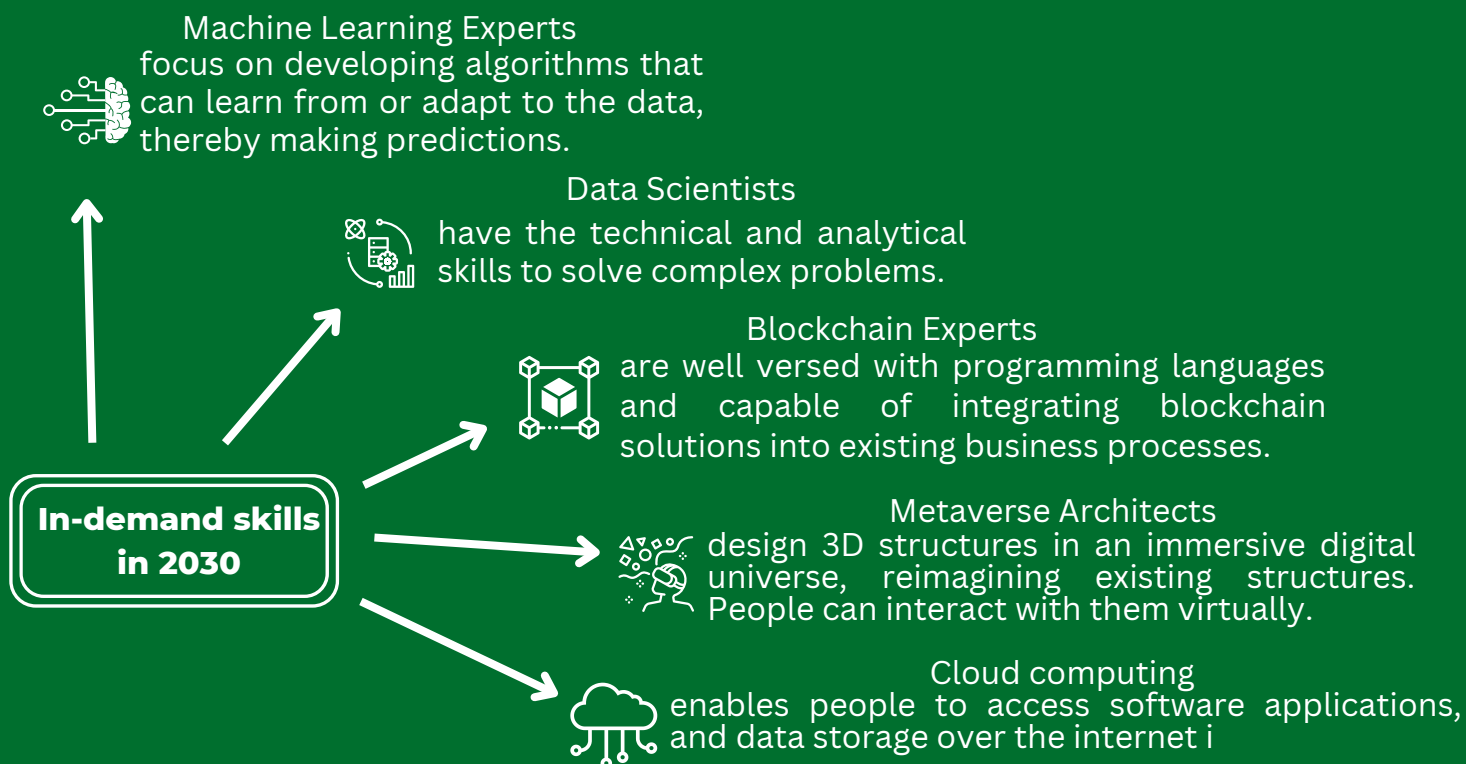
Assessing Human Behavior

The overlap of machine learning and computational psychiatry is making it possible to create a personalized mental health care today. AI can run predictions that are more precise in assessing human behavior.

Various universities across the world have responded by offering joint degrees on Information Technology and Psychology as well as concentrations in Technology and Mental Health such as in the Palo Alto University. Digital Mental Health is also an online course offered by Harvard⁽¹²⁾.

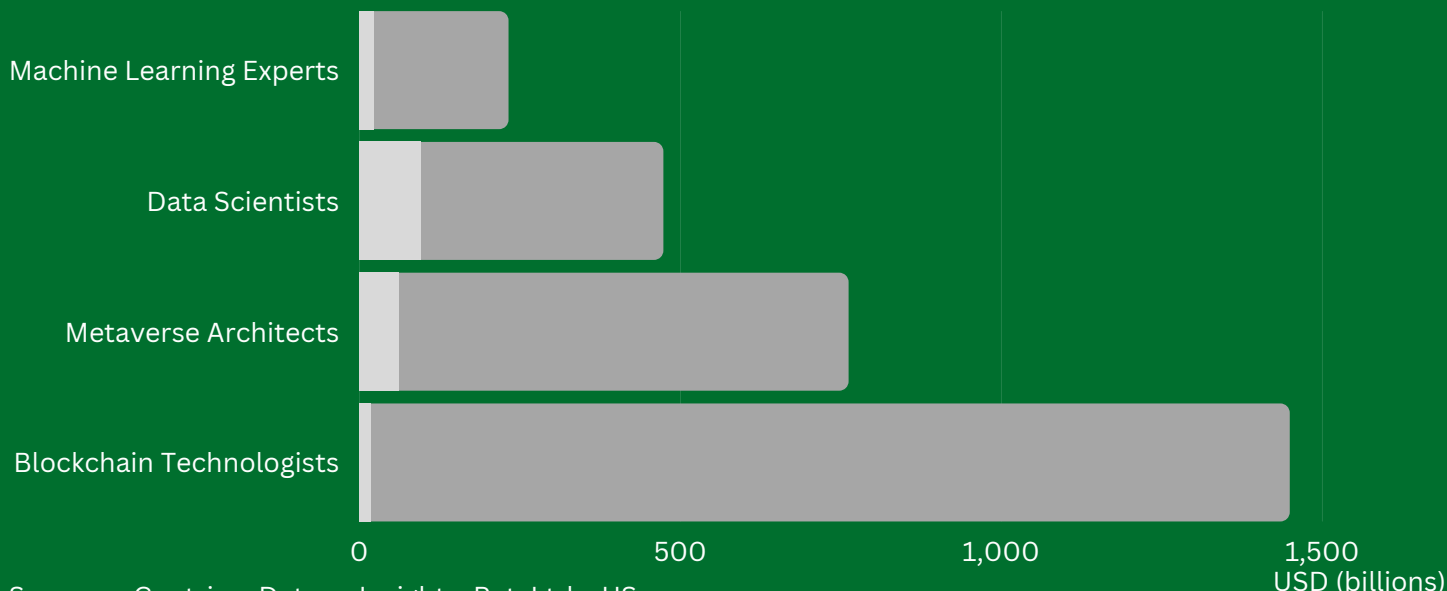
3.1 Tech Skills in Demand by 2030

In-demand skills are the most sought after skills by employers in a particular sector or industry. Some of the high-demand skills today, mostly tech-based, are highly priced because of their scarcity and specialization. According to Mckinsey's report, "In about 60 percent of occupations, at least one-third of the constituent activities could be automated, implying substantial workplace transformations and changes for all workers."⁽¹³⁾ Following are the type of skills whose demand is predicted to increase .



According to America's Bureau of Labor Statistics, technological occupations will grow 13% from 2020 to 2030, faster than the average for all occupations⁽¹⁴⁾. This means that some of the skills will be outsourced while demand for other skills will increase. Thus, below are growth statistics for the above mentioned skills.

■ 2022 ■ 2030



Sources: Contrive Datum Insights Pvt Ltd., US Bureau of Labor Statistics, PwC, Analytics Insight

3.2 Non-tech Skills in Demand by 2030

Along with the tech skills, human skills would be in demand as well. Despite inventions of Artificial Intelligence and ChatGPT that gives the impression of replacing human brains, machines and technology are not as efficient yet to fully replace humans at workplace. Thus, following is the list of human skills whose demand will increase by 2030.



Leadership Skills

are the abilities individuals demonstrate that help to oversee processes, guide initiatives and steer their employees toward goals.



Emotional Intelligence

the capacity to be aware of, control, and express one's emotions, and to handle interpersonal relationships judiciously and empathetically.



Cognitive Flexibility

is the ability to appropriately and efficiently adjust one's behavior according to a changing environment



Problem Solving Skills

Problem solving is the act of defining a problem; determining the cause of the problem; identifying, prioritizing, and selecting alternatives for a solution



Creativity and Innovation

is the act of turning new and imaginative ideas into reality and a process of turning a new concept into commercial success.



Team Work and Relationship Building

the ability to identify and motivate individual employees to form a team that stays together, works together, and achieves together



Decision-making

The ability to select between two or more alternatives to reach the best outcome in the shortest time.



Resilience in Workplace

is the ability to withstand adversity and rise back from difficult situations at work.



Adaptability

is a person's ability to adjust to changes in their environment. It expands a person's capacity to handle change.



Communication

enable individuals to understand others and to be understood themselves.

Disrupting the Medium of Instruction

Not only has the content of instruction changed, but the medium of instruction has also been transformed with changing times. It is no longer restricted to textbook based, rote learning but has expanded its realm beyond that. With the help of technology, the new learning methods now focus on clarifying concepts of learners through different streams.

Evidence shows that the EdTech sector is an important emerging educational player. Through virtual blackboards, online live classes, and Learning Management Systems, animated videos, augmented reality, and gamification, EdTech has brought in innovations that will change the way children learn and access education⁽¹⁹⁾.

Experiential Learning

Experiential learning is a research-based, hand-on learning process. Rather than using lectures, simulations, discussions, or other teaching methods, experiential learning requires the learner to act in the real world. This type of learning pushes students beyond the traditional classroom walls. It focuses on inquiry, application, and authentic learning opportunities. Following are some applications explained that manifest experiential learning in their application.

Application: Augmented Reality

360-degree visuals, graphic overlays and explorable interface. In practice, augmented and virtual reality allows practitioners of eLearning to fully immerse their students into the subject matter. Today, Virtual tours are also becoming more common among museums, allowing students to attend immersive, engaging field trips without ever leaving their homes. Some prominent examples of AR in education include the SkyView app which allow students to point their phones to the night sky to view an AR overlay of visible celestial objects. Virtual tours and 3D technology has also enhanced learning.



Future

In classrooms, AR will allow students to explore both virtual objects and virtual worlds. But beyond the classroom, people will have the option to employ AR as a private teacher wherever they go. Buildings will project history into their field of view. Museums might have AR-enhanced displays and every pond and park will double as a virtual-overlaid lesson in biology and ecology. Moreover, with advances in 3D scanning technology, medical students could learn anatomy in the classroom via detailed virtual, interactive models instead of renderings in textbooks or plastic models⁽²⁰⁾.

Application: Gamification



Gamification is the application of and interaction with learning material in a fun way. Gamification involves game-like mechanics to classroom learning thereby encouraging engagement⁽²¹⁾. When the understanding is high, so is the overall classroom performance. STEM toys that are Science, Technology, Engineering, and Math based toys are geared towards curiosity, learning, and education, like Kano's Harry Potter Coding Kit, Dash Robotics Jurassic World Robot, and Lego's Boost Creative Toolbox are some examples of gamification in education today.



Future



The future of gamification will be an integration of the virtual world and live performance using head-mounted gadgets and other physical and biological integrated systems. Particularly, big retail companies are betting on such technologies to revolutionize shopping experiences where they can exhibit products in virtual showrooms and allow customers to try products from the comfort of their homes⁽²²⁾. Not only this, but in health education, students will be able to use suturing scissors on animal tissue or artificial skin to practice incisions.

Problem Based Learning



Problem-Based Learning (PBL) is a teaching method in which complex real-world problems are used as the vehicle to promote student learning of concepts and principles as opposed to direct presentation of facts and concepts⁽²³⁾. Any subject area can be adapted to PBL with a little creativity. While the core problems will vary among disciplines, there are some characteristics of good PBL problems that transcend fields⁽²⁴⁾:

1

The problem must motivate students to seek out a deeper understanding of concepts.

2

The problem should require students to make reasoned decisions and to defend them.

3

The problem should incorporate the content objectives in such a way as to connect it to previous courses/knowledge.

Simulated Learning Experience is one of the many applications of Problem Based Learning that can be seen today.

Application: Simulated Learning



Simulation learning is a strategy educators can use to not only teach course concepts, but to also provide students with opportunities to apply new skills, and knowledge in a practice setting that mirrors the real world. Simulations lets a student develop key skills through trial and error in a safe and controlled setting first.. In aviation particularly, Redbird Flight Simulator is Advanced Aviation Training Device (AATD) in Walton Aviation Training School providing training from student pilot to professional crew⁽²⁵⁾. Moreover, in 2018, OpenAI's tool Dactyl was developed through a simulation for machine learning to train a shadow-hand.



Future



Advanced procedure training for pilots will be possible without using a flight simulator or on-site procedure trainer, like in Airbus Virtual Procedure Trainer (VPT). With Virtual Reality, the VPT will allow trainees to drill procedures repeatedly within a fully interactive cockpit. Trainees can then act intuitively on each switch and lever, following the correct sequence whilst building their 'muscle memory' and procedural knowledge. For instance, in health care, High-fidelity simulators at advanced level with haptic feedback (i.e., creating an experience of touch by applying force) will be adopted for ophthalmology and orthopedics⁽²⁶⁾.

Design Thinking



Design Thinking utilizes creative, innovative, and analytical skills to solve a problem. The process is driven by the end user's needs and experience. Design Thinking employs an iterative model, repeating the feedback-modification cycle till an effective solution is found⁽²⁷⁾. At Harvard Business School, courses like Design Thinking and Innovation are taught to approach problems through methods of collecting observations, cognitive flexibility, and drawing creative ideas for solutions⁽²⁸⁾.

Design thinking involves a five-stage model that was proposed by the Hasso Plattner Institute of Design at Stanford as they are one of the renowned teaching institutes for the way they teach and apply design thinking. These five phases includes empathize, define, ideate, prototype and test. Following is one of the applications of design thinking today.

Application: Human Computer Interface



Initially, Human Computer Interface (HCI) researchers focused on improving the usability of desktop computers (i.e., practitioners concentrated on how easy computers are to learn and use). Today, design thinking is seen in HCI. With the rise of technologies such as the Internet and the smartphone, computer use would increasingly move away from the desktop to embrace the mobile world⁽²⁹⁾. Using HCI, the Apple Watch has already introduced some really unique interactions like the digital crown and the ability to view another person's pulse.



Future



In the coming decade, these devices will become cheaper, more functional and less dependent on phone, which making them far more adoptable. Eventually people will be able to inject this technology directly into bodies. This means that a person will be able to monitor their vital signs without any hardware at all⁽³⁰⁾. This will prove helpful for medical students and practitioners in diagnosing health problems and diseases. Other than this, HCI will transform into a wearable technology that will be adopted worldwide; a small example of wearable tech today is the Google Glasses.

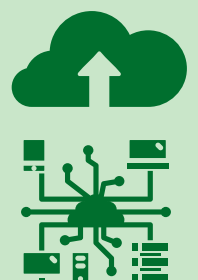
What's Next?

While learning experiences are changing even today in tandem with new technologies, certain scientific developments in the future have the potential to completely reconstruct the way learning is conceived and received. This includes the development of the Neuralink, further research into brain nanobots, and groundbreaking work on robots as teachers.

Neuralink: Store and Replay Content

Neuralink Corporation, founded by Elon Musk, is an American neurotechnology company that develops implantable brain-computer interfaces based in Fremont, California. Neuralink's device has a chip that processes neural signals that can be transmitted to phones and computers⁽³¹⁾.

This technology can change the process of learning. A cloud function will be introduced that will store and replay memories from a cloud. Not only this, but the tutors can also share their knowledge in the cloud that can be accessed by students⁽³²⁾. Moreover, this brain-computer chip when connected to the cloud, has access to the internet thereby making it possible to memorize new information at the very moment they search it.



Nanobots: Brain to Computer

The idea of downloading brain knowledge in the computer using nanobots, is the scientific advancement of the 21st century. This technology is under research by Xperiti, a financial research platform working on human intelligence. Because of a greater understanding of the human brain today, the use of nanobots will be possible.

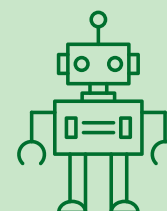
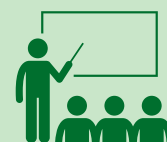
In the later half of the 21st century, experts are hopeful that nanobots would have fully developed⁽³³⁾. This will transform learning experience as instructors would not have deliver lectures anymore as they can simply download the knowledge and share it with students. This way, the use of textbooks and notes would be minimized.



Robots as Teachers

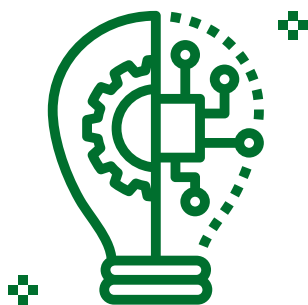
Putting a robot in the classroom may seem like a far-fetched idea in the future but researchers are already working on it. In the 2000s, engineers from the Tokyo University of Science designed Saya, a humanoid robot that could react to students' behavior in full autonomy⁽³⁴⁾. With human stance, emotionally expressive face features, and vocalization capabilities, the robot could call the roll, deliver a lesson, and monitor students' actions.

Robotics companies today like UBTECH Robotics Inc. are designing playmate-like robots to provide interactive learning experiences to STEM students. In the future, it is predicted that robots can replace teachers in the classroom. If not, they can at least become their active assistants who can check assignments and deliver tutorials effectively.



How to be Prepared for the Future?

With fast paced learning today, students are required to constantly adapt with changing circumstances. With upcoming technologies and innovations that were once only imagined are becoming a reality today. This means that people, especially students, need to be acclimatized to the idea that change would be the only constant. This involves altering their behaviors, habits, and routines in the way they perceive learning. The role of learning institutions is then deemed significant in upbuilding the students' skills since the future of learning would be complex and fast-paced. Colleges and universities therefore need to reshape their teaching methods and prepare for the future.



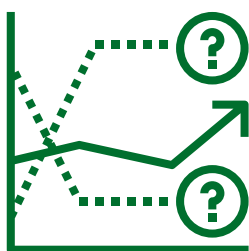
Enhancing Computational and Technological Literacy

Universities need to embrace emerging types of literacy to prepare students for high-tech future. Recently, MIT has created an App Inventor to help students learn how to develop new apps with coding. They have also developed Shadowspect, which allows students to learn geometry with 3D puzzles. So, such a data-rich, student-centered pedagogical approach will enhance their technical literacy and broaden their vision. Other than this, with the introduction of ChatGPT, learning institutions must acclimatize the students with its different uses in data science and analytics.



Educational Content that Adapts and Evolves

Awareness of the different technologies and how to use them is essential for learners today. When students are comfortable with learning new technologies, they will be better at adapting to technological change. Programs that upskill and reskill people makes human resources more versatile as well as step into expanded roles in less time⁽³⁵⁾. The educational content needs to be revised often so that students can get hands-on experience of the latest innovations. Particularly, the introduction of DALL-E in digital arts should be highlighted in institutions for the purposes of design. This is how students as well as the educational content will evolve with latest trends and technology.



Learning as a Non-linear Process

Non-linear learning is learning that happens via any medium in the absence of a pre-defined order. Students should be able to pursue any branch of knowledge that attracts them at any point in time and must not be restricted to one stream of education and rather encouraged to explore. And so, the learning institutions should give time and autonomy to students for engaging their curiosity in a new learning landscape.

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