TSINGHUA UNIVERSITY

IEDE PROGRAM

MARCH 27-APRIL 21, 2023

INNOVATING EDUCATION FOR LIFELONG LEARNING

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CHAPTER I

1.1. Research background

1.2.1. Lifelong learning as a support mechanism for enhancing capability of the workforce in digital economy

Lifelong learning has been one of the priorities for implementation in the countries by international organizations for more than one hundred years. The concept of lifelong learning gained immense popularity in recent years due to the rapid technological advancements and the need for individuals to stay relevant in their professional and personal lives. Lifelong learning is also important from the perspective of the 2030 Agenda for Sustainable Development, in which it was declared that education must be inclusive and equitable quality and should promote lifelong learning opportunities for all individuals in the world (https://www.uil.unesco.org/en/higher-education-lifelong-learning?hub=270).

Lifelong learning in the digitalized world and in the post-pandemic era so important because of some factors which are mentioned in the following ways:

Post-pandemic consumers are turning to digital learning

Higher education is broadening beyond formal education to incorporate workplace learning

There is a new opportunity for the great reengagement rather than the great resignation

Learning becomes ingrained acroos a lifetime, with new skills being acquired to match longer careers and changing lifestyles

Growing importance of certification at the natural conclusion of any learning activity
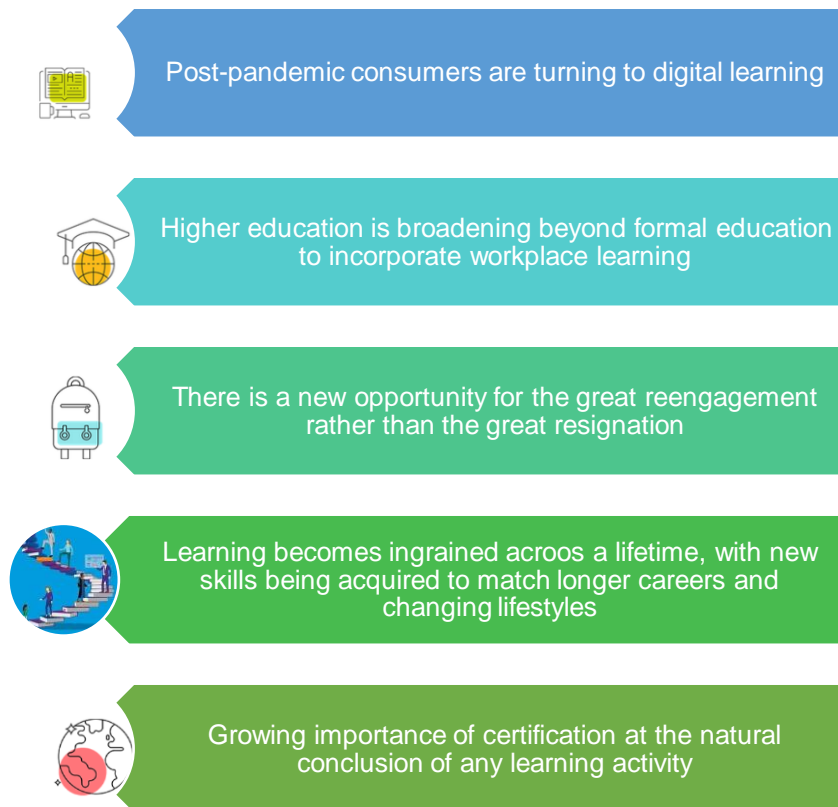
Figure 1. Importance of lifelong learning in the global economy

Indeed, it is no longer enough to obtain a degree or certification. Therefore, individuals must continually update their skills and knowledge to remain competitive in the job market. As a result, there is a growing emphasis on innovative ways to deliver lifelong learning opportunities. From this point of view, education, in particular, higher education plays a crucial role in providing individuals with the necessary skills and knowledge to succeed in their careers and personal lives (Weiler, 2018).

By 2050, the number of adults aged 80 in the world will be three times higher than today (UIL MEDIUM-TERM STRATEGY 2022–2029). Adults may anticipate working longer, changing jobs more frequently, and seek to reinvent employees' abilities on a previously unheard-of scale. Older adults who pursue lifelong learning may be able to continue working and contribute significantly to society.

ACCORDING TO THE PEW RESEARCH CENTER

73% Adults consider themselves lifelong learners

63% Of working adults are professional learners

Source: Docebo (2019). E-LEARNING TRENDS, p. 11

https://fliphtml5.com/duyqh/wffr/basic

As we can see, attention is focused on the broad concept of general knowledge literacy with the objective of improving life quality of the citizens (Weiler, 2018).

Industrial societies and the emerging knowledge societies are inherently complex structures. Almost all domains of society will have to cope with transitions to new ways of working, shorter work time per week, retirement at higher ages, a more sophisticated relationship between humans and machines. In order to face this complexity, the labor force

has to be prepared to adapt to these new situations which occur during an entire work lifetime (Weiler, 2018). This leads directly to the educational innovations for individuals' lifetime learning in order to survive in the rapidly changing world. Therefore, it is irrefutable fact that collaboration is indispensable mechanism among stakeholders, including educators, employers, policymakers, and learners themselves. Collaboration is necessary to ensure that the education provided aligns with the skill demands of the workforce and meets learners' evolving needs (Kaewhanam, 2023).
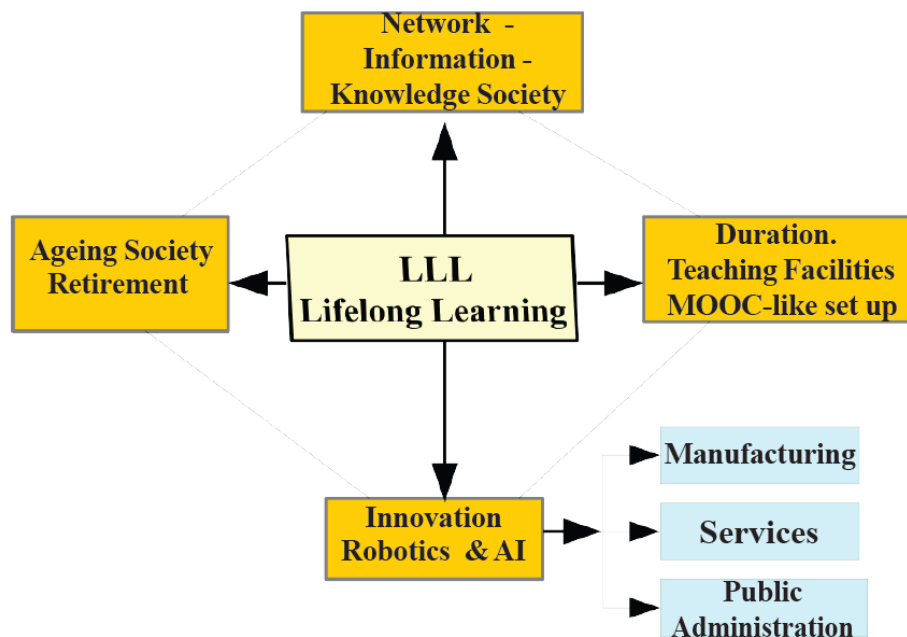
Figure 2. Concept map of Lifelong learning.

Source: Weiler (2018), p. 176

Taking into account above-mentioned thoughts, it can be mentioned lifelong learning is not just limited to formal education but also includes non-formal and informal learning. This underscores the importance of recognizing and valuing different forms of learning and providing opportunities to learn beyond traditional education systems (Gouthro, 2022). Thereby, these opportunities are mentioned as the benefits of lifelong learning.
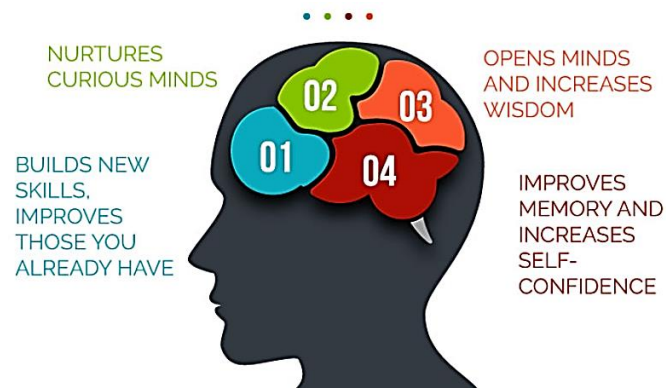
Figure 3. Benefits of Lifelong Learning

Global learning market mentioned that expected size of the learning market by 2030 will be £7Tn, global learning market will be the second largest component of GDP in most countries as well as over a billion learners will have moved through formal education by 2030 (https://plc.pearson.com/en-GB/company/global-learning-market).

Figure 4. Compound Annual Growth Rate for Global Learning Market

Source: https://plc.pearson.com/en-GB/company/global-learning-market

Use of Cloud Based Authoring Tools and LMS

Use of authoring tools and LMSs that are based on this technology is increasingly becoming popular because of enhanced efficiency, lower costs, better accessibility and quicker deployment.
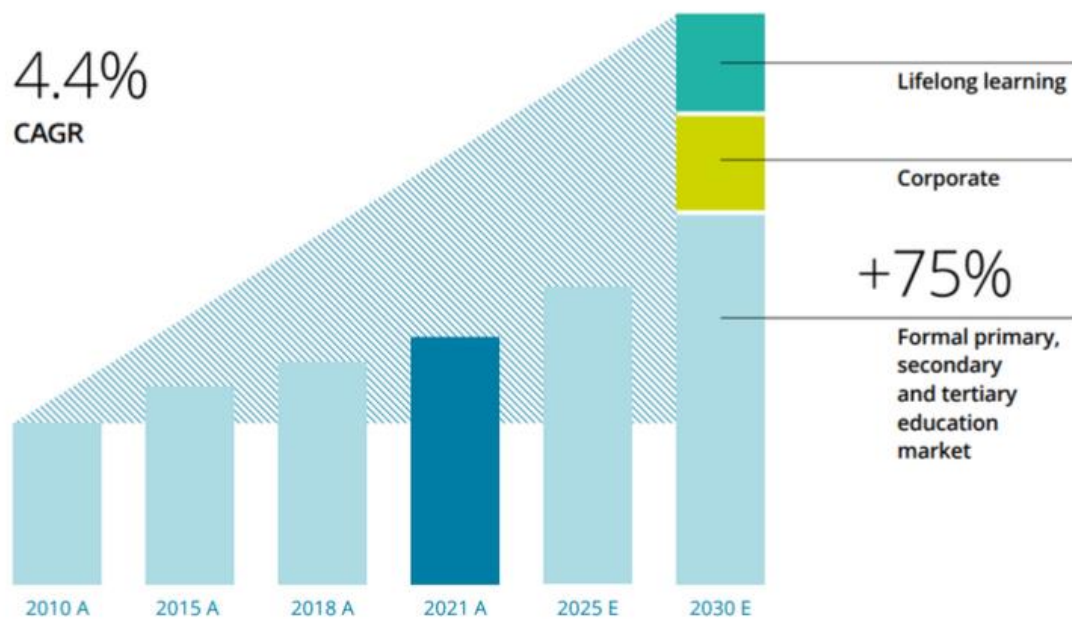
Mobile Learning

M-learning is increasingly preferred by companies to impart effective training because it facilitates learning on the move, cost effective, better performance and a better choice for Gen-Y workers.

Collaborative Learning

Collaborative learning has received a major fillip with the emergence of Web 2.0. Its elements such as Blogs, Discussion Forums, Podcast, Social Media etc., help transmit thoughts of fellow professionals in a cost effective manner.

Bite-sized Learning

The main reason for the growing popularity of bite-sized courses is that they can be used to enhance worker performance and provide JIT support on mobile devices and quickly access the content at the time of need.

Translation of Online Courses

Companies are increasingly seeking high quality translations of online training courses to efficiently equip their multi-lingual international workforces.
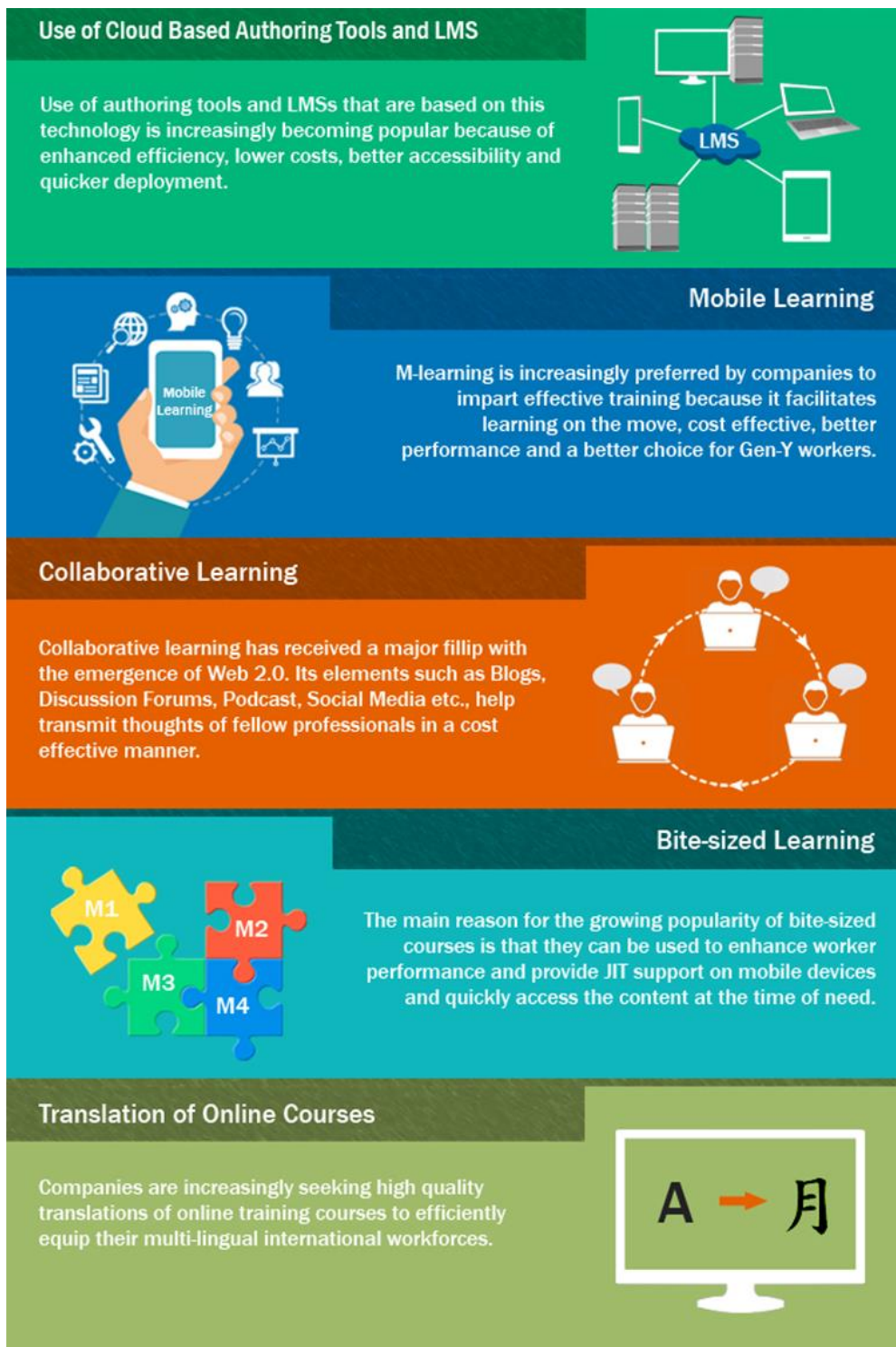
Figure 5. Major e-learning trends in the countries

Likewise, McKinsey's study (2021) over higher education students and faculty staff in the USA showed that there are 8 dimensions of learning experiences of students can impact on the improvement of students' engagement process:

1. Creating road map for students in order to support them to focus on their progress.

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2. Seamless connections for accessing easily virtual learning platforms

3. Range of learning formats for engaging teaching approach with both self-guided and real-time classes, and lots of interaction with instructors and peers.

4. Captivating experiences through different courses with up-to-date content.

5. Creating adaptive learning environment through personalized learning platforms which give feedback without teachers

6. Real-world skills application without going to industry through virtual tools

7. Timely support to students

8. Strong community

From this perspective, lifelong learning extends to non-traditional students, meaning those who do not enter higher education after finishing secondary education and before the age of 25. Lifelong learning thus encompasses a variety of target groups from different backgrounds, with varying prior experiences of education, and with a range of learning needs to which HEIs must respond (Figure 5).
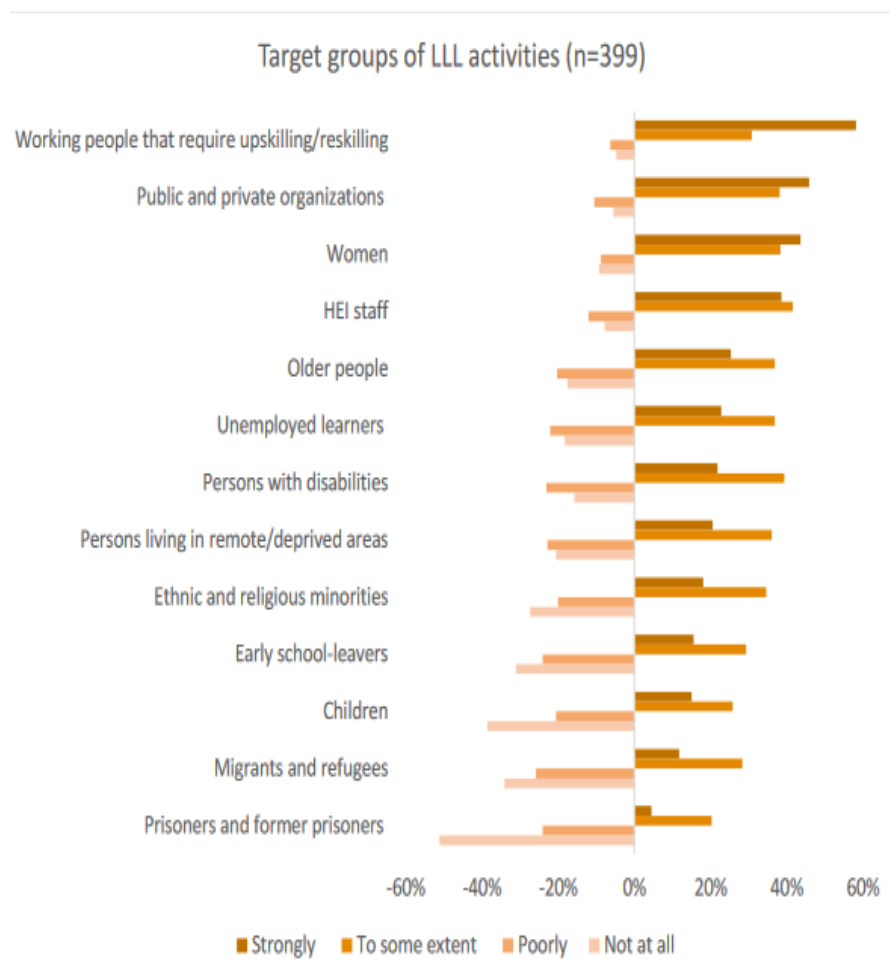

Figure 5. Overview of these target groups

1.1.2. Virtual learning environment as a support mechanism to lifelong learning

An increase in individuals' satisfaction is a crucial factor that is fueling the growth of the global market economy. For employees to be productive, it is imperative that they receive proper training. Individuals who begin their job without adequate training are susceptible to experiencing stress and anxiety, which is why new hires should be trained adequately (Docebo, 2019). The initial training that an employee receives is significant, and regular learning sessions are equally important as knowledge diminishes over time. Providing training to employees not only enhances their job satisfaction but also increases their knowledge and keeps them informed about the latest developments in their field. Indeed, traditional education systems are often rigid, with fixed curricula that may not adapt well to changing needs. Innovative approaches to education have become essential to meet the diverse and ever-changing learning needs of individuals. Innovating education for lifelong learning requires a shift towards more technology-centered and flexible learning environments. This shift requires educators to embrace new teaching methodologies and technology-enabled learning modes. The use of online learning platforms, gamified learning modules, and personalized learning approaches are some examples of innovative teaching methodologies that have been increasingly adopted to enhance the learning experience. Here we have given some examples for learning approaches and teaching and learning methods.
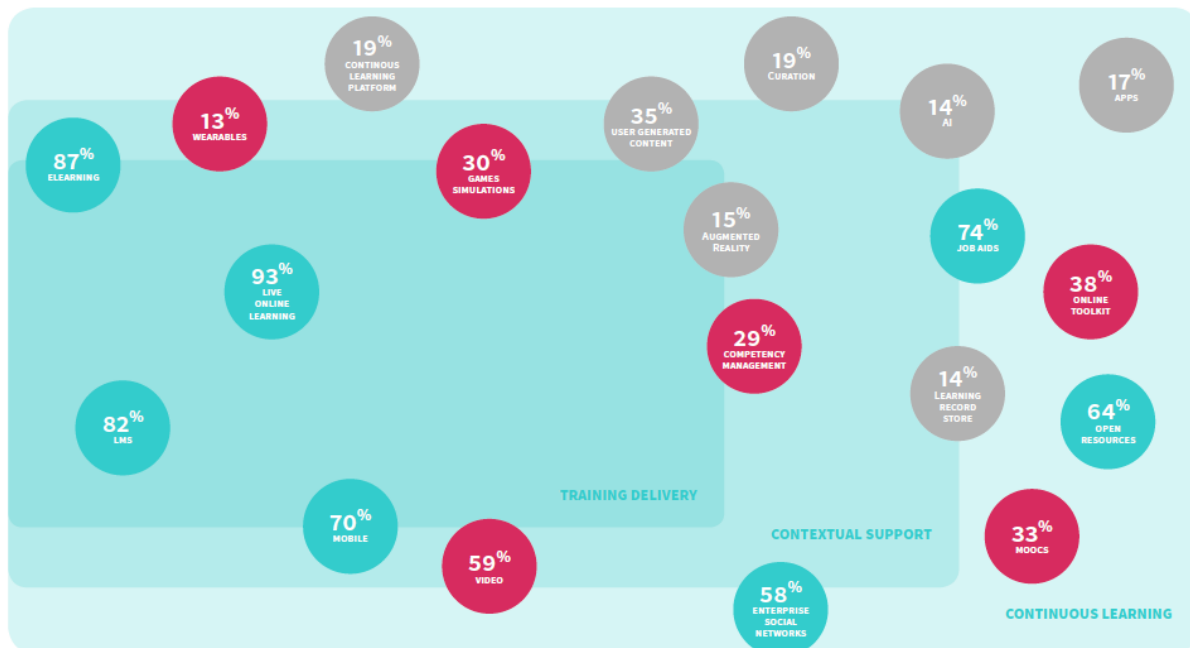
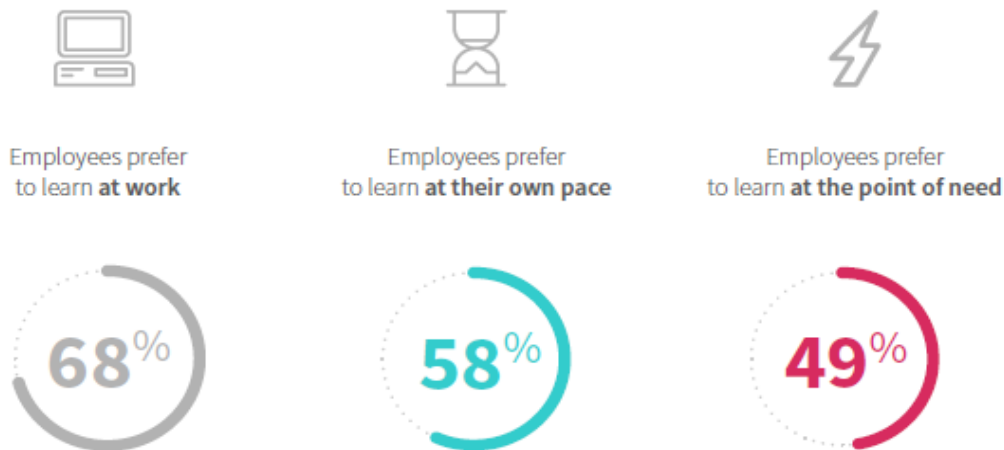| Continuous Learning	Contextual Learning	Training Delivery
Tools can support self-directed learning in the flow of work	Tools can support application of training back at work.	Tools that can improve efficiency of course delivery

Source: Docebo (2019). E-learning trends

The researcher Taylan (2020) mentioned that the current century requires several competences and some sorts of skills, like problem-solving, collaborative work, utilizing digital platforms without any restrictions, and overall, it is a must for every individual, especially work forces to involve in lifelong learning. Personalized learning, where training is customized based on the individual needs and learning styles of employees, is gaining popularity in the corporate e-Learning market.

The COVID-19 pandemic has led to a surge in demand for remote learning solutions, accelerating the growth of the corporate e-Learning market. The global corporate e-Learning market is highly competitive, with companies such as Cornerstone OnDemand, IBM Corporation, Oracle Corporation, and Skillsoft Corporation among the key players. These companies are investing in developing innovative e-Learning solutions and expanding their geographic reach through partnerships and acquisitions.
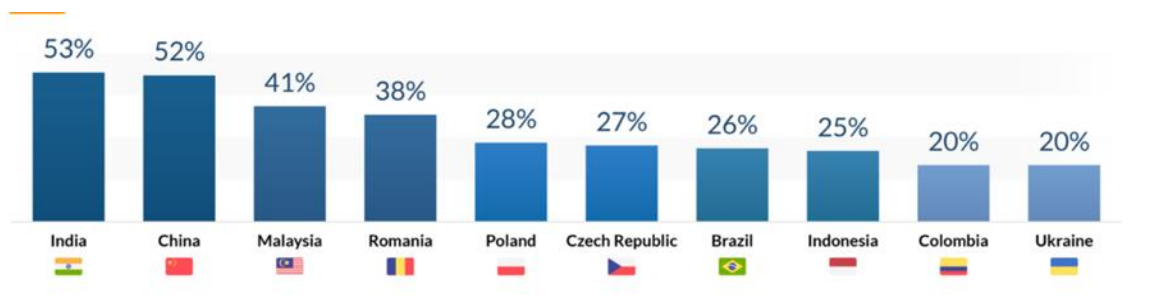
The main reason for the growth of the e-learning market is the flexibility and affordability of e-learning, allowing learners to study from anywhere, which enhances convenience and overall effectiveness of learning activities (Docebo, 2019). Mobile learning technology options, that replicate the desktop learning platforms, play a major role in this. Additionally, the progression in learning technology is empowering individuals to choose when, what, and how to learn on a diverse range of subjects, be it for personal or professional aspirations.

THE RISE OF DIGITAL IS TRANSFORMING TALENT DEVELOPMENT

Employees prefer to learn **at work**	Employees prefer to learn **at their own pace**	Employees prefer to learn **at the point of need**
68%	**58**%	**49**%

Source: Docebo (2019). E-learning trends, p. 7

It is obvious in the world, the Asia Pacific region is expected to be the fastest-growing market for corporate e-Learning due to the increasing adoption of technology and the growing demand for employee training in emerging economies such as India and China.

India	China	Malaysia	Romania	Poland	Czech Republic	Brazil	Indonesia	Colombia	Ukraine
53%	52%	41%	38%	28%	27%	26%	25%	20%	20%

Figures 6. Top ten countries with the highest virtual learning adoption rates

Source: https://financesonline.com/elearning-trends/

As we can see, the rates are not more than 53 percentage, and the least percentage is 20. Thus, it can be observed that only two of the countries at the top are ahead of the other countries with a percentage of slightly more than 50. They even were marked on the top of this ranking. Ukraine was noted with the lowest interest rate, so it can be determined that the level of progress of technology adoption is not high in all countries. The adoption of e-learning can be influenced by various factors, such as access to technology, internet connectivity, government policies and funding, cultural attitudes towards education and technology, and the quality of existing educational infrastructure (Barnes, et al., 2016). Countries with better access to technology and high internet penetration rates are more likely to adopt e-learning. Additionally,

countries that recognize the importance of investing in digital education and have policies in place to support it are likely to have higher rates of e-learning adoption.

On the other hand, despite some countries have some problems to adopt digital technologies and e-learning, Technavio envisages that Global Online Education Market was envisaged for 2020-2024 years that the online education will increase 18 percent till the next year (2024) and $ 247.46 Billion Growth Projected in Global Online Education Market During from 2020 to 2024 (Technavio, 2021).

Figure 7. Global Online Education Market 2020-2024

Source: https://edufirst.ca/247-billion-growth-in-global-online-education-market/

It is possible to inculcate 21st century skills through lifelong learning which requires from individuals, digital literacy and capability to utilize educational technologies. Therefore, in order for individuals to be equipped with twenty-first century skills, educators and the education systems should be organized by these skills, and integrated with ICT, e-learning, digital education, digital platforms, and virtual education, etc. (Demir et al., 2022). This could lead to the self-directed learning in which learning can be under the control of the learners (Boyer et al., 2014).

1. **Virtual Training is key**	6. Hybrid Learning
2. **Microlearning environments**	7. No Code Tools for Tech-Averse Users
3. **Off-the-Shelf Courses**	8. Demand for Accessible Learning Program
4. **Planned Learning Journeys**	9. Adaptive Learning as a Standard
5. **Smart Content Curation**	10. Need for Social Learning

Table 1. Trends in Virtual Learning

Source: https://financesonline.com/elearning-software-trends/

Organizations have realized that using the best elearning software tools can increase productivity by 30%. Not just that, elearning boosts employee engagement by 18%, and it typically requires up to 60% less employee time (https://financesonline.com/elearning-trends/). One of the main important issues is that learning through virtual worlds has been well-know with better knowledge retention rates (approximately, 60 percent), whilst in-person training has not much reputation like that. It is undeniable fact that some of the benefits can delude society. From this aspect, 77 percentage of corporations in the USA addressed online learning systems in 2017 is unbelieveable (StrategyR, 2021).

Figure 8. Importance of virtual learning in the modern life

Referring the data of IDC Worldwide Semiannual Digital Transformation Spending Guide, we mention that the global annual spending on technologies and services will hit a whopping $3.5 trillion by 2026 (https://www.mobileappdaily.com/future-technology-trends). The spending on digital transformation (DX) is at an estimated compound annual growth rate of 16.3% in the next four years. In the future digital realities, related products and services will be hyper-personalized and hence, to decipher that, we will require a technological vision that meets the requirements of constantly changing on-demand experiences

(https://www.mobileappdaily.com/future-technology-trends).

According to the scientists' forecast, the value of mobile technology, clous services and virtual reality will rocket to $680 million by 2027. This will be a turning point in the world education system with providing accessible and immersive learning environments to the learners. Today with the increase in mobile learning and personalized learning, the shift towards mobile learning, or m-Learning, has opened up new opportunities for the corporate e-Learning market to provide on-the-go training solutions to employees. Artificial Intelligence

(AI) and Machine Learning (ML) are also being integrated into corporate e-Learning solutions, providing personalized and automated learning experiences for employees.

GetSmarter, a 2U, Inc. brand, recently conducted research on the future of work, which surveyed in 2022 over 8,000 professionals from 106 countries to gain insight into the fast rate of change and how they're tackling the need for skills development (www.wgu.edu/blog/why-lifelong-learning-key-business-success1901.html). According to the research, many employers (47 per cent) already recognise this need and are addressing upcoming challenges by upskilling their staff in some form or another, whether it be through online courses or internal training.

Figure 9. Top ways talent developers demonstrate the success of learning

Source: https://financesonline.com/elearning-trends/

1.1.3. Challenges for applying lifelong learning in the higher education systems.

Despite lifelong learning is necessary for the emerging countries in the knowledge society and digital economy, the applying of the lifelong learning in the society and enlightenment of society for the skills, especially digital skills are one of the arduous tasks for those government which desire to enhance the individuals' literacy for reaching knowledge society. It is essential to address the barriers to lifelong learning, such as financial constraints, lack of motivation, and inadequate access to education resources. Overcoming these barriers involves designing accessible and affordable education systems and promoting a culture of learning that values lifelong learning.
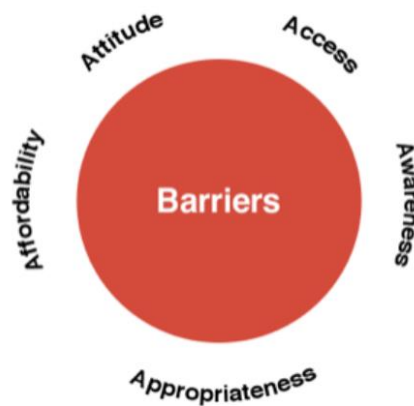
Figure 11. Barriers for lifelong learning

McKinsey (2021) found out while many colleges and universities are interested in using more technologies to support individuals' lifelong learning, the top three barriers indicated are lack of awareness, inadequate deployment capabilities, and cost. In this case, the support by university administrators is important.
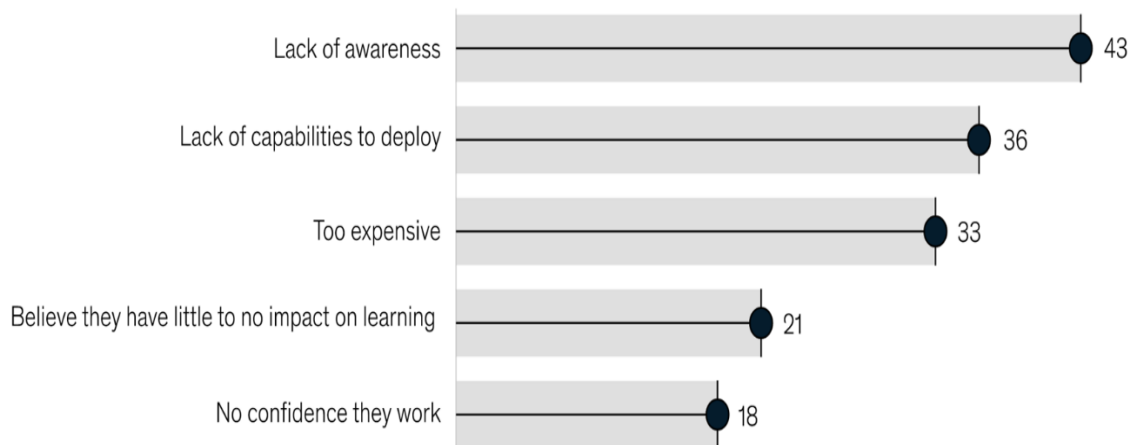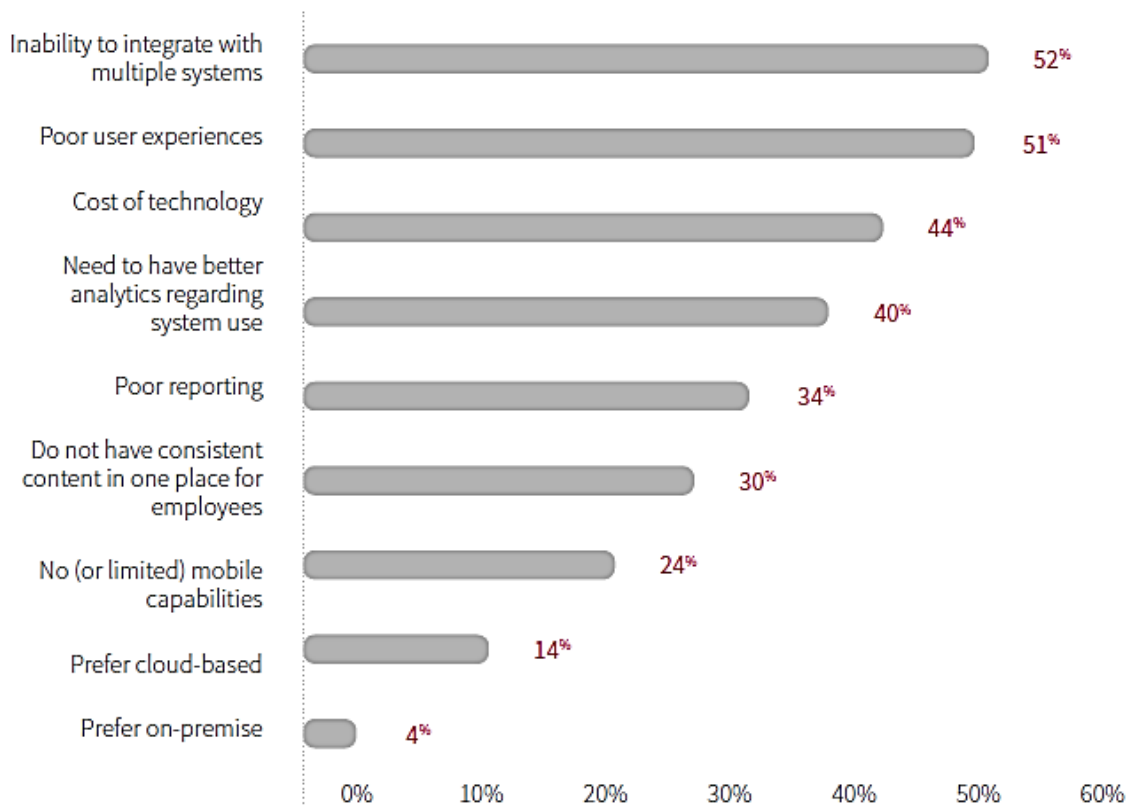

Figure 12. Top five barriers to using learning tech (percentage of student and faculty respondents (n=1429) by McKinsey (2021).

Some technologies lag behind in adoption. Tools enabling student progress monitoring, AR/VR, machine learning–powered teaching assistants (TAs), AI adaptive course delivery, and classroom exercises are currently used by less than half of survey respondents. Anecdotal evidence suggests that technologies such as AR/VR require a substantial investment in equipment and may be difficult to use at scale in classes with high enrollment. McKinsey (2021) found out that small public institutions use machine learning–powered TAs, AR/VR, and technologies for monitoring student progress at double or more the rates of medium and large

public institutions, perhaps because smaller, specialized schools can make more targeted and cost-effective investments.

The biggest barriers in the application new technologies to develop lifelong learning activities:

Barrier	Percentage
Inability to integrate with multiple systems	52%
Poor user experiences	51%
Cost of technology	44%
Need to have better analytics regarding system use	40%
Poor reporting	34%
Do not have consistent content in one place for employees	30%
No (or limited) mobile capabilities	24%
Prefer cloud-based	14%
Prefer on-premise	4%

Source: Docebo, (2019), p. 12

The report presents the results of a global survey administered by the UNESCO Institute for Lifelong Learning (UIL) on the contribution of universities and other higher education institutions (HEIs) to lifelong learning. Online survey was launched by UIL and IAU, and distributed in English, French, Spanish, Chinese and Arabic via their networks. A glossary of relevant terms accompanied the survey to ensure that respondents had a common understanding of what was being asked. After conducting a pilot study with a sample of 18 HEIs from April to May 2020, the survey was launched to collect data between October 2020 and January 2021.

The factors identified as key strengths – institutional autonomy, an enabling culture, technical capacities, and political will and leadership – are promising given their relevance for institutional implementation. At the same time, financing for lifelong learning in the higher education institutions was identified as a challenge by 67 per cent of participating institutions,

a crucial finding given that adequate funding is a prerequisite for the implementation of programs.

1.1.4. Challenges for designing and implementing Online Education Platforms in the emerging countries

The following challenges prevents the adoption of lifelong learning in the institutions of emerging countries:

1. Lack of time: Lifelong learning requires a significant amount of time and effort, which can be challenging to fit into a busy schedule.

2. Financial constraints: Many lifelong learning courses and programs can be expensive, making it a challenge for individuals with limited financial resources. As well as, technology is not only related to the attendances' problems. Some technologies lag behind in adoption. Tools enabling learner progress monitoring, AR/VR, machine learning–powered teaching assistants (TAs), AI adaptive course delivery, and classroom exercises are currently used by less than half of survey respondents. Anecdotal evidence suggests that technologies such as AR/VR require a substantial investment in equipment and may be difficult to use at scale in classes with high enrollment.

McKinsey (2021) found out that small public institutions use machine learning–powered TAs, AR/VR, and technologies for monitoring student progress at double or more the rates of medium and large public institutions, perhaps because smaller, specialized schools can make more targeted and cost-effective investments. Despite the use of AI-powered tools was rare, it is promising in the future higher education to use these tools in order to tailor courses to each student's progress, reduce their workload, and improve student engagement at scale.
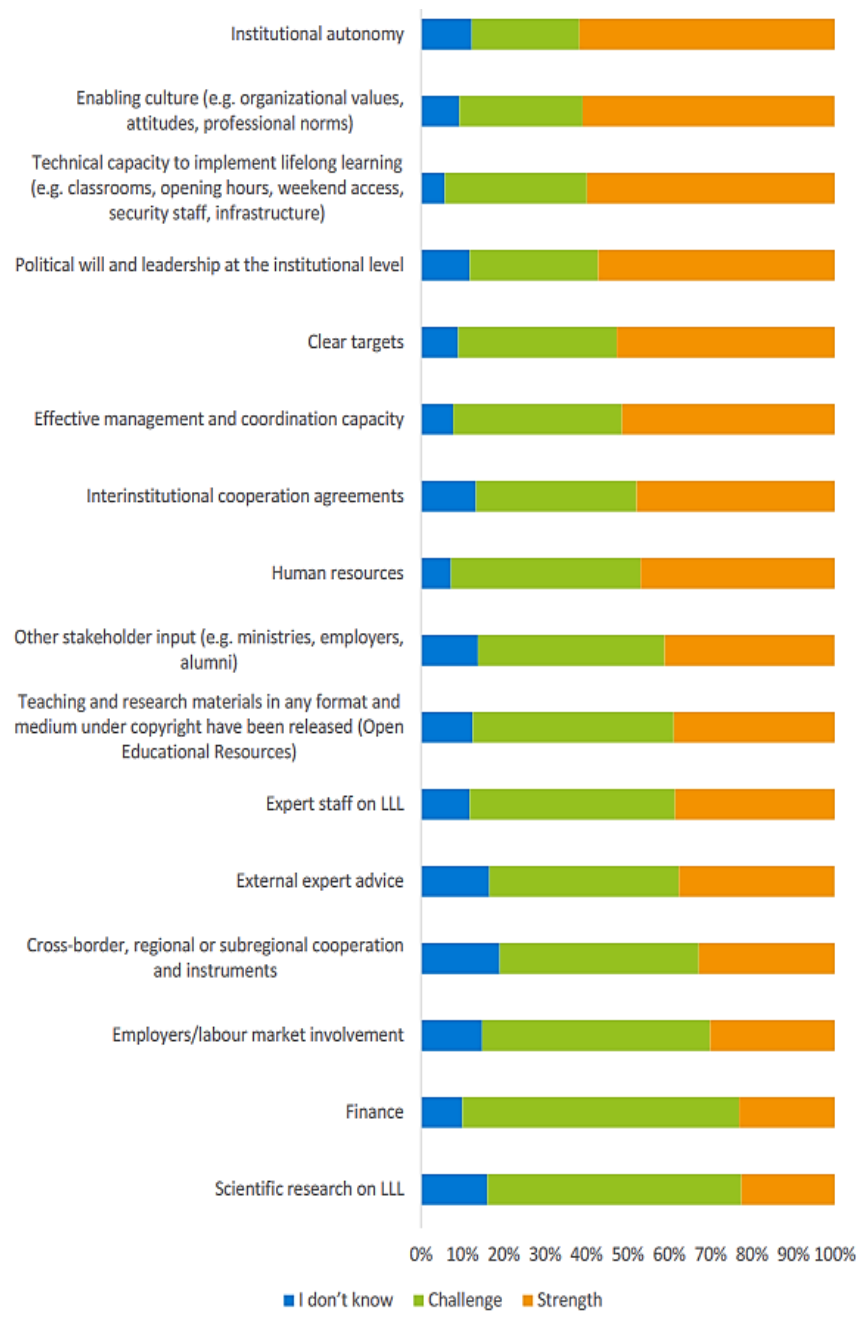
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Figure 13. Strengths and challenges encountered when implementing Lifelong Learning in Higher Education Institutions (n=399)

3. Age-related barriers: Aging can bring physical and cognitive changes that can make learning more difficult, creating barriers to lifelong learning.

4. Technology proficiency: As technology continues to evolve, individuals who struggle with digital literacy may have challenges accessing online learning resources.

5. Lack of motivation: Lifelong learning requires a significant amount of self-motivation, which can be challenging for individuals who lack the drive to continue learning. Employees are not motivated to take courses as they feel the content is not relevant for skills development. According to a survey, 45% of workers said that "current training offerings aren't related to employees' daily responsibilities." This is a barrier in achieving business goals as driving employee engagement and retention is crucial to deploying an effective corporate learning strategy.
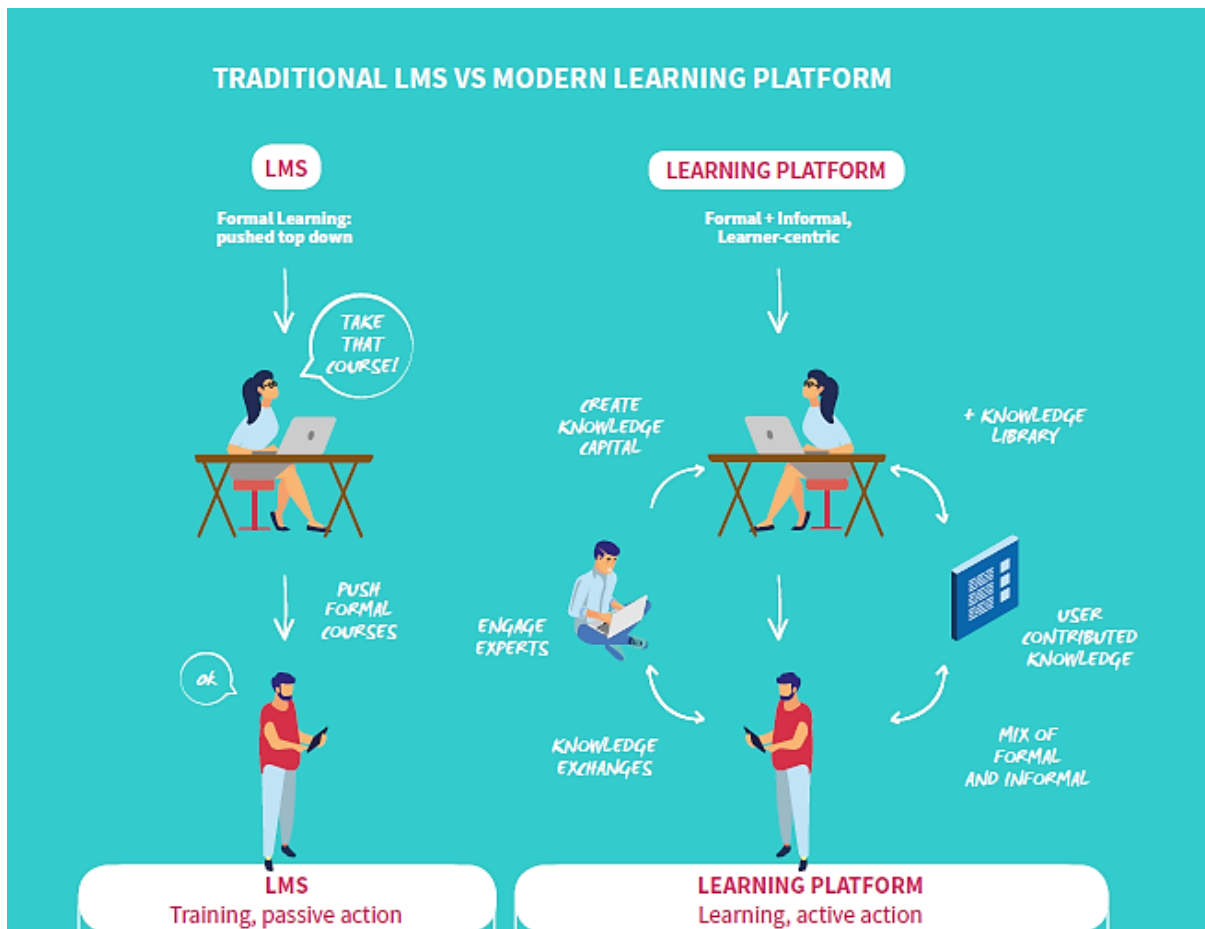
To empower learners with relevant knowledge that will help them in career advancement, companies need to identify learners' needs and close skill gaps. With the help of a modern learning platform and suitable content partners, companies can develop and deliver content that will not only help them achieve their business goals but also help their employees achieve their goals.

6. Limited access to educational resources: Some individuals may live in areas with limited access to educational resources, making it challenging to pursue lifelong learning.

7. Lack of social support: Without support from family, friends, or employers, individuals may struggle to stay motivated and on track in their lifelong learning journey.

1.3. Significance of the study

This study will focus on how to innovate higher education of emerging countries in order to develop and implement lifelong learning strategies. Increasing awareness and creating motivation, competencies and skills can help individuals from younger ages to the older ones to improve their performance, and make them competitive in the skilled labor marked in the globalized and digital era. This study aims to achieve implementing digital learning technologies such as AR, VR, and other tools that facilitate learnings and enhance productivity of the individuals and achieve certain goals for the lifelong learning tendencies. This study will review the best practices around the world and aims to provide recommendations on innovating education using digital platforms for lifelong learning that will enable institutions to integrate innovative digital technology in accordance to the fast-pace technology.

CHAPTER II

THE USE OF CLOUD-BASED PLATFORMS IN THE VIRTUAL EDUCATION

2.1. Innovating Learning Management Systems

The fast-ever growing of technologies has affected almost every domain of our daily life. In education, the ICT tools are more and more used to improve teaching/learning activities and to help both students and teachers to teach and learn online. Moreover, Technology-enabled learning is increasingly important and pervasive in higher education and lifelong learning. For [1], Learning Management Systems (LMS) are web-based systems that allow teachers and students to implement learning/teaching activities. LMS can also be defined as software platforms designed to manage, distribute and track employee training. This means that users (teachers and students/learners) can share materials, knowledges, submit and return assignments and communicate online. As popular example of LMS, we can cite Moodle, Blackboard, Canvas, and Schoology, among many others.

Forbes advisors have published the list of the best Learning Management Systems of 2023. Among them, we have MATRIX LMS, Talent LMS, Absorb, iSpring, Docebo, D2L, Brightspace LMS, Blackboard Learn LMS, Canvas LMS, Moodle LMS, Edmodo LMS, CYPHER LEARNING LMS [3]. Ease of use, Features, Customer support, Pricing and Scalability are the main criteria chosen by Forbes advisors to carry out this list of best LMS.

Google Classroom **8.8 8.1** 95	Docebo LMS **9.5 5.7** 92	
Agylia **8.1 7.6** 70	Absorb LMS **8.0 8.7** 68	
D2L Brightspace LMS **7.9 9.1** 67	Instructure Canvas LMS **7.9 8.5** 63	
Talent LMS **7.8 8.9** 58	Edmodo LMS **7.8 7.7** 58	
Moodle **7.7 8.8** 53	GnosisConnect **7.6 8.1** 51	
LearnUpon **7.7 6.2** 50	Litmos LMS **7.6 8.4** 49	
Axis LMS **7.6 8.5** 47	SmarterU LMS **7.6 8.9** 47	
Grovo LMS **7.5 8.7** 46	ExpertusONE **7.5 8.6** 45	

Furthermore, a LMS consists of two parts: an admin interface where a training manager performs the core, back-office tasks to organize their company's learning programs and a user interface that runs inside the browser which is what learners and teachers see when they are doing their activities. Considering [2] work, LMS bring many advantages in the educational system such are:

- Easy way to organize and present educational content
- Open access
- flexibility and quickness of use
- Easy way for assessment
- Money and time saver:
- Communication and interactivity

Based on the data given by Brandon Hall Group, 37 percentage of organizations are about to replace their current learning management system (LMS) into the technology-enabled cloud-based platforms.
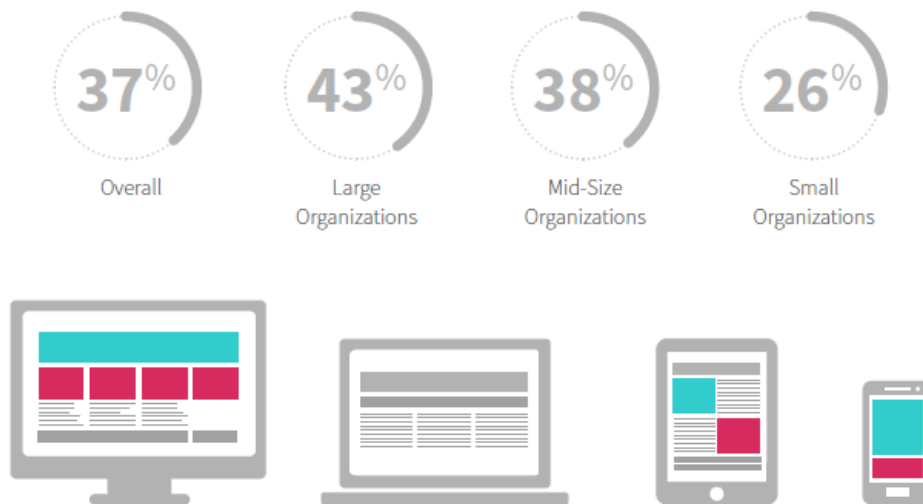
Source: Dorbeco, (2019), p.13

According to a study by Brandon Hall Group, 23% of companies have been using their learning software for over 5 years. While this may not seem to be a long time, some breakthrough innovations have been made in the last 5 years such as microlearning, social learning and artificial intelligence-powered learning to name a few. 58% of companies are dissatisfied with their LMS because it is outdated and does not meet business needs. However, replacing a learning management system is not easy (Docebo, 2019, p.17).

In any case, the choice of one LMS among others depends of the users' needs. Here are some factors to keep in mind [3]:

- Ease of use: The best LMS platforms are easy to use and require little to no training. They should be intuitive and user-friendly.

- Features: The best LMS platforms offer a robust feature set that meets the needs of both businesses and learners.
- Customer support: The best LMS platforms offer excellent customer support, so you can get help when you need it.
- Pricing: The best LMS platforms are affordable and offer a variety of pricing options to meet your budget.
- Scalability: The best LMS platforms are scalable, so you can grow your learning program as your needs change.

As lifelong learning is a process of learning along the life, LMS seems to be a great opportunity because, most of the learners are workers and don't have enough time to study onsite. So, the flexibility of LMS is a famous advantage to make possible lifelong studies.
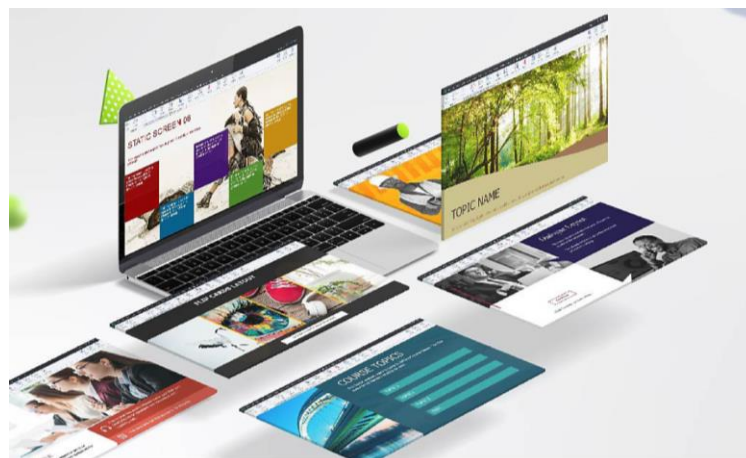
Referring Brandon Hall Group, Docebo (2019) mentioned that in the next few years, the desired improvements will be as following:

Large Organizations		Small & Mid-Size Organizations
87%	Ability to integrate with other systems	75%
84%	Mobile capabilities	72%
82%	Reporting and analytics	78%
79%	Social learning	72%
79%	Ease of use	91%
71%	Virtual instructor training/web conferencing	72%
NA	Content Management	84%
NA	Testing and assessment	78%

The future of Learning Management Systems (LMS) for lifelong learning is promising. As more individuals seek career advancement and personal development, LMS will become more advanced and efficient in delivering personalized education. It is expected that future LMS platforms will be more creative and inte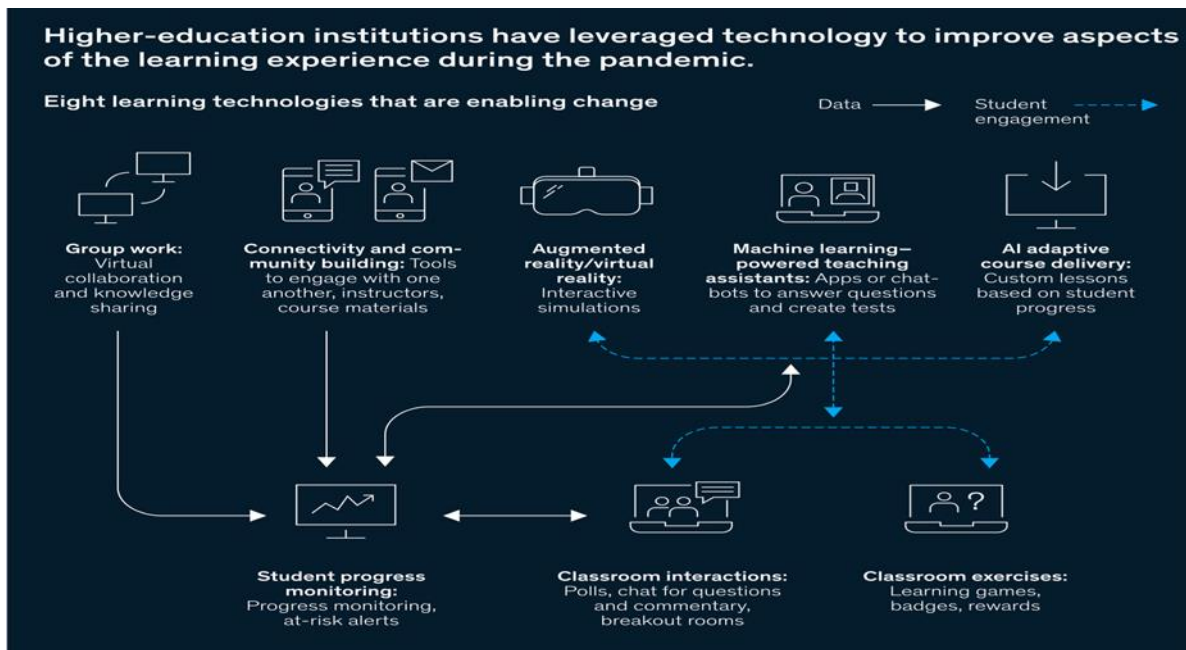ractive, using cutting-edge technologies like artificial intelligence and machine learning to provide customized learning experiences. Learners will be able to access content from any device, including mobile devices and virtual reality headsets, and engage in collaborative learning through social media and chat bots. Moreover, LMS will offer microlearning options, where learners can choose targeted topics or specific skills to acquire, making learning more flexible and personalized.

Higher-education institutions have leveraged technology to improve aspects of the learning experience during the pandemic.

Thus, lifelong learning is becoming essential in our rapidly changing world, and technology will play a crucial role in enabling individuals to access education anytime and anywhere. LMS will be at the forefront of this new era of learning, allowing learners to stay competitive in their field, acquire new skills, and pursue their passions. Additionally, LMS will enable organizations to provide continuous training and development to their employees, resulting in a skilled workforce that can adapt to changes in the industry. Overall, LMS will continue to evolve, and the future looks bright for the individuals and organizations that embrace them to facilitate lifelong learning.

2.2. Application of Cloud - based learning in adult learning through life-long education

Since 1994 with the web standards establishment, several technologies as web services have been developed through Internet. Among them, Cloud Computing is one of the famous and worldwide technology which allows users from different areas of the world to use applications, store and access data in huge online storage space without buying and maintaining needed IT infrastructures. Cloud Computing as multi-services provider that shares resources (data and applications), is considered as one of the greatest achievements in the web history. In the past decades, Cloud Computing has offered to individuals and companies several facilities in data and computing management with providing many services and resources. Cloud Computing has been adopted by many companies and web users because it allows comprehensive access, low cost and high performance.

As the innovative solution of storing data and providing services, many scientists have tried to define Cloud Computing according to their research interests. According to the National Institute of Standards and Technology (NIST), Cloud Computing is a model for providing ubiquitous, convenient, on-demand access to a common pool of configurable computing resources (for example, networks, servers, storage, applications, and services) that can be rapidly released and provisioned with minimal management effort or service provider interactions [4]. This definition is used as a baseline for understanding cloud computing and its applications. It shed light on the way that, resources in Cloud Computing are configurable according to user needs with a minimal technical and cost requirement. This specific way is called flexibility which is one of the core advantages of Cloud Computing. Gai Keke [5] also defines Cloud Computing as an approach of information sharing or services providing on both Internet and Intranet on client demand. The client here can be organizations or individuals. This definition outlines the fact that, Cloud Computing is configurable on both Internet and Intranet and, activities in Cloud depend of the client needs. Cloud computing can also be defined simply as a set of resources allocated on demand [6]. Cloud computing offers several advantages to its users such as: low cost, quick and easy access, unlimited computing power available on demand, virtual machine, permanent availability of data and services, high performance, good security management, reliable technology, unlimited storage capacity, enhanced collaboration, sharing of resources, convenience, flexibility in work, quick data storage, throughput and scalability [5]. Moreover, [5] has defined the followings as the main benefits of Cloud Computing.

- It allows companies to use computing resources that they don't own or maintain, and thereby reduces the cost of computing.
- It provides most prebuilt components part, so that companies don't have to build anything from scratch.

Given numerous advantages of Cloud computing, cloud technology is used in several domains as well. In education domain, cloud-based learning has emerged. The Cloud has offered significant potential in changing how education as an industry works from with the perspective of offering online programs so as to modify the traditional working ecosystem. Nowadays, many institutions, policy makers and administrators in the educational field want to adopt and integrate cloud-based technology to support lifelong learning [9]. Arun [7] has listed 8 surprising ways by which cloud applications is influencing today's education system as follow:

1. Students save on expensive textbooks

Cloud-based textbooks are an effective solution to the textbook expensiveness. Digital content tends to be lot less expensive thus, allowing lower-income students to get access to the same quality of learning material as other students.

2. Learning material need not be outdated

Cloud-based material makes it easy to update content real-time hence, enabling students to gain constant access to the latest learning resources.

3. No need for expensive hardware

Even a cheap smart phone can allow you to access related academic applications. Furthermore, there is no need to invest in external storage devices since there are several platforms available that offers free cloud-based storage services.

4. No need for expensive software

Considered to be one of the biggest advantages of cloud-based computing is the development of the Software-as-a-Service (SaaS) model. It is common for software programs to now be available either free or at a low-cost subscription thus, making it easy for students to use high quality academic applications without breaking the bank.

5. Reaching out to a diverse range of students

Since education has moved online, it has become more and more possible for adult students to finish their high-school education. Alternative forms of education are nowadays becoming easily available thus, making it easy for individuals to receive specific training in areas that may improve their employability.

6. No need to carry around devices

Students and professors needn't worry about carrying around devices such as thumb drives and CDs. With no worry of losing important data due to loss of device, breaking of CDs or not having the information not loaded properly, students can enjoy access to academic information anytime, anywhere.

7. Easy access

This brings us to the next point. With everything from lesson plans, grades, notes, slides, labs, etc. can be made available on cloud applications, all the tools that are used in teaching can be easily uploaded and accessed anytime by the students and professors.

8. Data security

Most cloud-based mobile applications offer strong authentication facilities for making sure that the academic material is made available only to the right people. Furthermore, if some modification happens to the IT infrastructure at the university, the content will still be available to professors and to the students as well.

Finally, cloud-based mobile applications in education makes it easy for students to share their assignments with teachers in an easy and trackable manner. Cloud facilitates easy collaborations, allowing student groups to work on projects and assignments on cloud in an effective manner.

Dahdouh et al, have designed a Cloud-based e-learning model in Figure 1 [8]. In this model, learners, teachers and administrators can easily access the resources through the Cloud infrastructure. Each of the stakeholders has different roles in the platforms. It's showing in this diagram how easy it is to learn with cloud-based solution. The above diagram demonstrates how the three service layers are prerequisite in a cloud-based e-Learning model. The Software as a Service are service layers that offer features such as the content, access to content, collaborative learning and monitoring. facilitates interaction among students, teachers and educational institutions [8].

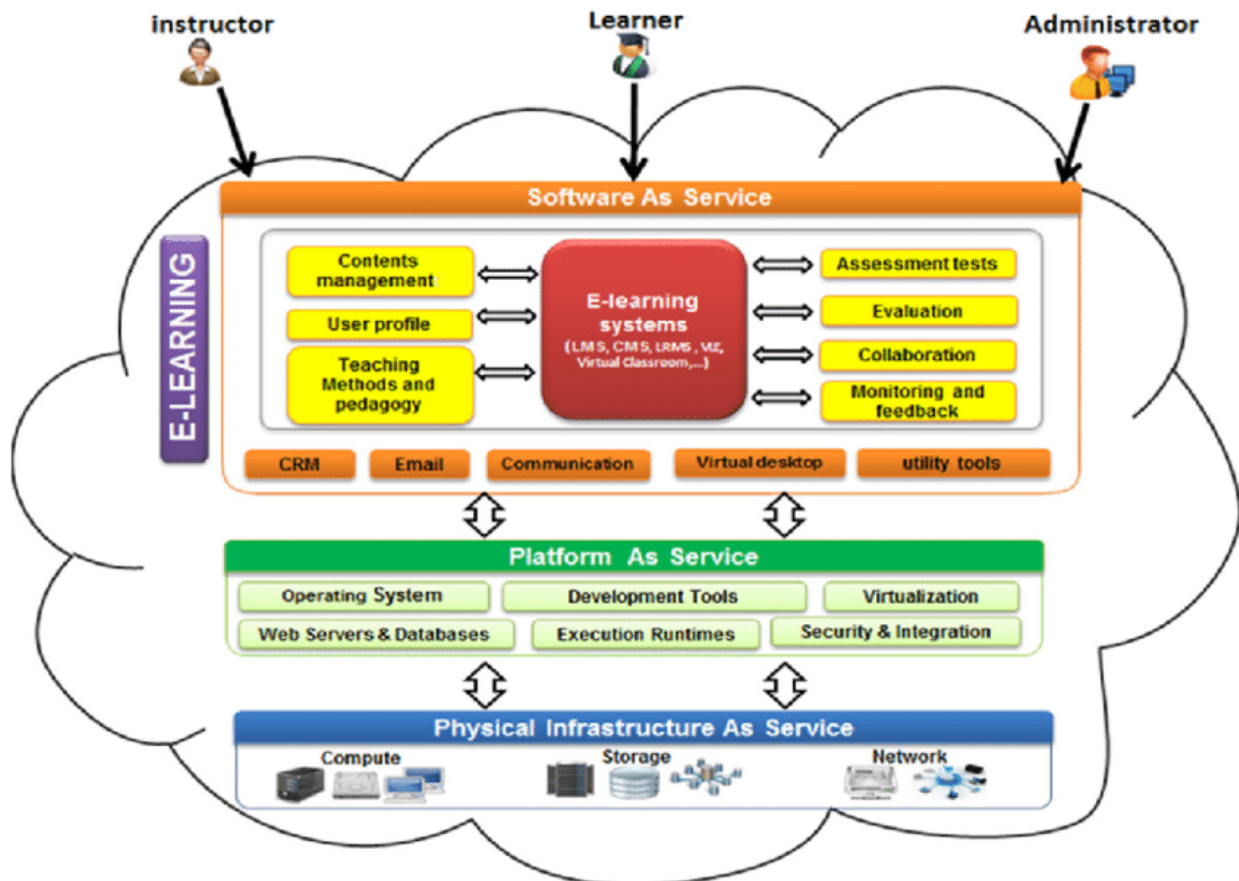*Figure 1. Proposed e-Learning based Cloud Approach (Source: Dahdouh et al., 2017)*

The integration of cloud computing systems into e-Learning has brought many opportunities in the education field [10]. One main advantage of e-Learning through cloud computing is to provide students and teachers access to data and high-quality software through different cloud models [10]. Data can be accessed anytime and from anywhere.

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CHAPTER III

Activities for higher education in lifelong learning

Following the perceived inherent academic-related concerns (e.g., lack of motivation, dissatisfaction with a major, and difficulties in transitioning from school to work; among some categories of university students (e.g. vocational and adult education students; the possibility of students' academic engagement and tendency for lifelong learning will continue to rise. Because there are concerns about the extent to which students engage in their studies, as well as a desire to promote personal and professional development, stimulating students' interests in learning as well as encouraging their abilities to invest time in academic activities for personal, social, and professional development has become vital to successful learning outcomes. Consequently, optimum ability to be effectively engaged in one's academic and professional development may be attained by encouraging self-direction in learning (SDL); which is characterized by the ability to take initiative in learning tasks with or without assistance We, therefore, proposed that self-direction in learning is a potential motivational model to facilitate study engagement and promote the tendency for lifelong learning (LLL) among university students. As a result, maximizing one's ability to be successfully engaged in one's academic and professional development can be accomplished by encouraging self-direction in learning (SDL), which is defined as the ability to take initiative in learning activities with or without assistance. As a result, we suggested that self-direction in learning is a potential motivational model for increasing study engagement and encouraging lifelong learning (LLL) among university students. [1]

3.1. Curricular activities

Co-curricular activities are those activities that are undertaken along with academic studies. Typically, co-curricular activities are carried out outside the normal classrooms, but they supplement the academic curriculum and help in learning by doing. These activities help students to develop problem-solving, reasoning, critical thinking, creative thinking, communication, and collaborative abilities.

Co-curricular activities in school might be compulsory such as music, art, or drama classes that take place during the day. Others could be voluntary, such as participating in a school sports team, school debating teams, or student newsletters editorial team. In either case, participation helps students in emotional development, social skill development, and overall personality development. Therefore, the importance of co-curricular activities is immense.

3.2. Importance of Co-Curricular Activities

In the 21st Century, the world is changing fast. Therefore, the conventional education curriculum, which was developed in the early 20th Century, has to pave the way for a new kind of education and learning. In the book [21st Century Skills: Learning for Life in Our Times](#), the authors Bernie Trilling and Charles Fadel have premised that **"the world has changed so fundamentally in the last few decades that the roles of learning and education in day-to-day living have also changed forever".**

Also, in the book *Five Minds for The Future,* the author **Howard Gardner** has outlined five specific mental abilities that will help one be successful and happy. The five mental abilities or Minds as written by Howard Gardner are – **The Disciplinary Mind** (expertise in various subjects), **The Synthesizing Mind** (ability to integrate concepts from different disciplines to solve a problem), **The Creating Mind** (ability to think creatively to solve problems), **The Respectful Mind** (appreciation of the diversity in individuals), and **The Ethical Mind** (fulfilling one's duties and responsibilities in the society as a citizen).

These concepts emphasize that in the 21st Century, education and learning must surpass the four walls of a classroom. **So, the core aim of education and learning should be to foster holistic development.** However, the importance of co-curricular activities cannot be overlooked in fostering holistic development.

Holistic development essentially means intellectual, physical, emotional, and social development, which can be achieved only through proper education. Therefore, education plays a fundamental role in holistic development.

Co-curricular activities help develop students' holistic development and assist in developing critical skills and abilities to be successful and happy in 21st Century life and workplaces. Therefore, the importance of co-curricular activities is immense during school and college education.

Essential skills and values that you can develop through co-curricular activities

When theoretical curriculum and co-curricular activities are integrated, your chance of learning more and exploring your strengths, interests, and abilities becomes higher. Therein lies the importance of co-curricular activities, which are supplementary to the theoretical curriculum.

It is true that much of your intellectual development happens, to a great extent, in the classroom itself. But, various other aspects of your personality, such as emotional and social skill

development, happen to a large extent through co-curricular activities. Therefore, holistic development cannot deny the key role and importance of co-curricular activities.

Essential skills and values that you can develop through co-curricular activities are:

1. **Logical and analytical thinking** – Analyzing reasons behind events and situations

2. **Critical thinking** – That is examining concepts, ideas as well as problems and issues

3. **Creative thinking** – In other words, thinking of newer ways to solve problems; visualization; thinking of new ideas

4. **Problem-solving skills** – For instance, solving problems utilizing various concepts, solutions, etc.

5. **Leadership skills** – For instance, taking initiatives and responsibilities; influencing others in working for a good purpose; setting goals; motivating others to work towards goals; taking accountability

6. **Social skills** – Includes collaboration; teamwork; building good relationships with others

7. **Emotional skills** – Understanding your strengths and weaknesses; controlling your emotions as well as empathy for others

8. **Communication skill** – Includes the power of expression, listening to others, public speaking etc.

9. **Technology skills** – Using various computer software and apps to get things done

10. **Social values** – In other words, respecting differences among individuals, respecting others' values and culture

11. **Ethical values** – For example, maintaining ethics in public life; good moral values etc.

12. **Recreational values** – Understanding the importance of leisure and recreation; participating in leisure and recreational activities. [2]
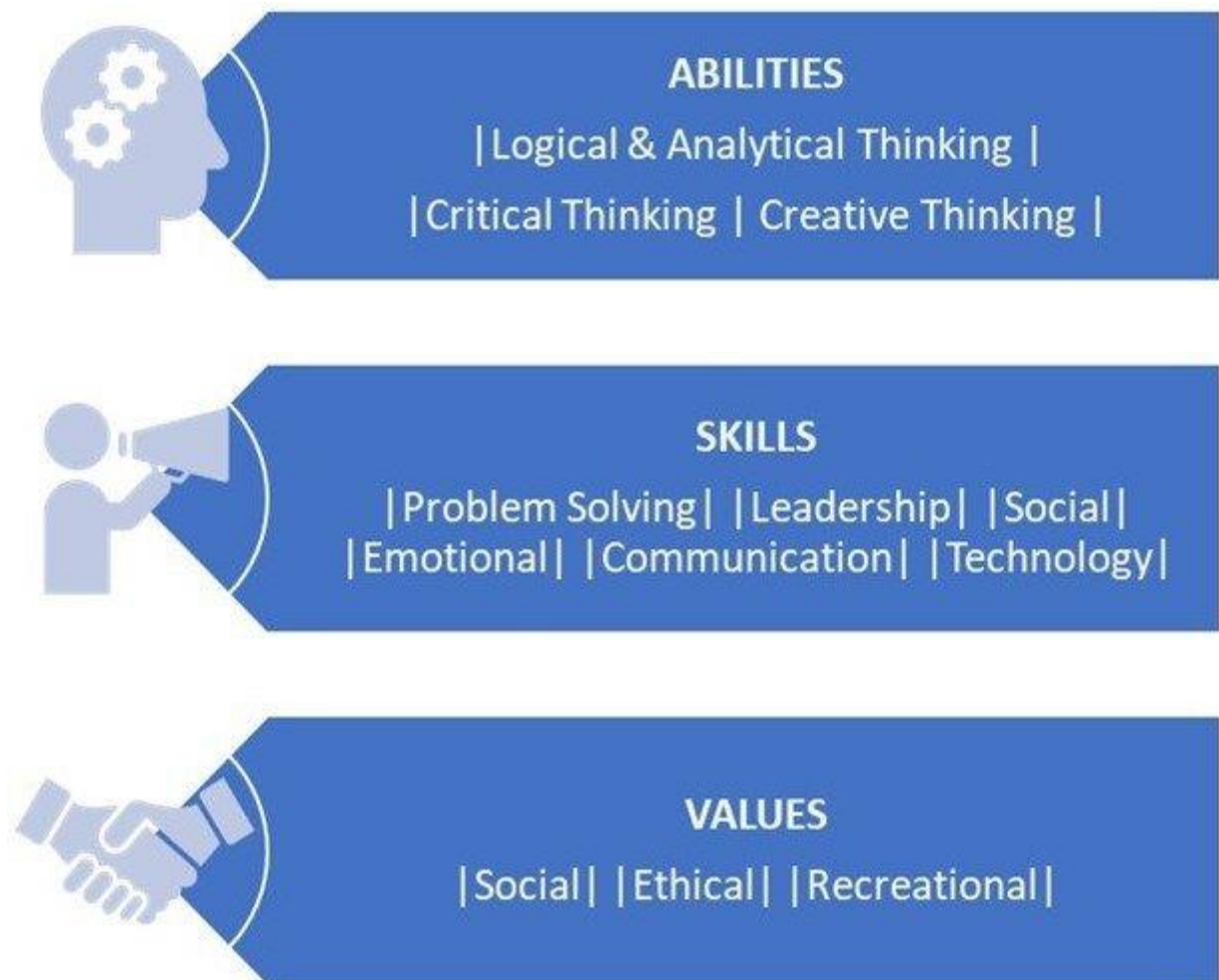
ABILITIES

| Logical & Analytical Thinking |

| Critical Thinking | Creative Thinking |

SKILLS

| Problem Solving | | Leadership | | Social |
| Emotional | | Communication | | Technology |

VALUES

| Social | | Ethical | | Recreational |

Figure 2: Essential Abilities, Skills, and Values developed through co-curricular activities

3.3. Extracurricular activities

As students enter an ever more challenging graduate employment market, through its access and participation plans (APP),i the higher education (HE) sector is encouraged to investigate and deliver improvements to the student experience so that they will be better equipped to compete upon graduation. This is especially true for widening participation (WP) students from disadvantaged socio-economic backgrounds, as they are significantly less likely to obtain a higher degree classification of a 2:1 or First Class and less likely to progress to professional, graduate level employment.

It has been found both from internal analysis and the wider literature that for a range of academic, economic, social and cultural reasons, disadvantaged groups may be less likely to take up voluntary pursuits that may enhance the student experience. To this end, participation in ECAs is as much about the gaining of social capital as it is about gaining academic capital.

However, if students with pre-existing socio-economic and demographic advantage disproportionately take up such pursuits, the 'nontraditional' student experience can be further disadvantaged.

3.4. Case Study

Students who choose to participate in extra-curricular pursuits may have an existing predisposition towards possessing the 'capital' associated with success at university and beyond. As May et al. suggest, ECAs can be 'key to developing self-identity, social networks and career pathways and prospects. Potentially, social capital can be gleaned from a variety of sources in what might be referred to as 'economy of experience' whereby students have access to a wider range of activities across the university to help improve their engagement and, by association, their attainment and employability. ECAs are effectively held outside of the normal timetabled 'classroom' provision by Michael *Kerrigan* in *Nottingham Trent.* Some were directly related to academic skills (e.g. Libraries and Learning Resources) whilst others had less obvious links (e.g. NTU Sport). [3]

This study focuses on nine distinct interventions. These were selected primarily for reasons of pragmatism; data had been systematically recorded by the delivery teams, and unique student identifiers for undergraduate participants were provided to the research team for the following ECAs:

• Collaborative Engagement and Retention Team (CERT) Mentors; 2017/18; n=485

   o CERT mentors are year two- and final-year undergraduates who peer mentor year one undergraduates through a series of face to face and digital communications

• Students in Classrooms (SinC); 2014/15 to 2017/18; n=895

   o Students are deployed in local primary and secondary schools to mentor and assist pupils with their learning.

• Nottingham Trent Volunteering (NTV); 2014/15 to 2017/18; n=2,345

   o Students volunteer to participate in local, national and international community and charitable pursuits.

• Grads4Nottingham (G4N); 2016/17 to 2017/18; n=125

   o Undergraduates work with local businesses to help solve business challenges.

• Humanities at Work (HaW); 2016/17; n=700

- o Undergraduate Humanities students participate in a fixed period of assessed voluntary work with a host organization outside of academia
- Legal Advice Centre (LAC); 2014/15 to 2017/18; n=515

  - o Undergraduate Law students volunteer in the University's teaching law firm, participating in a variety of legal projects and cases.
- Libraries & Learning Resources: Skills Development; (LLR); 2017/18; n=1,495

  - o Students participate in a range of co-curricular workshops and academic skills development sessions.
- NTU Sport; 2014/15 to 2017/18; n=23,020

  - o Student members access the University's sports facilities and/or partake in a variety of sports clubs.
- Scholarship Projects for Undergraduate Researchers (SPUR); 2014/15 to 2017/18; n=180

  - o Students collaborate with academic staff on research projects in a shared field of interest.

Participants were matched, using their unique identifiers, with NTU student records for each of the corresponding academic years. This provided the research team with a rich data source comprising key influential factors, such as gender, ethnicity, socio-economic status and pre-entry qualification, to permit comparison between expected and actual participant outcomes. These outcomes were average grade-based assessment scores, module pass/failure rates, final degree classifications and progression to further study or professional employment. Results were compared between UK domiciled participants of the various ESAs and UK domiciled non-participants, taking account of the noted confounding factors.

Participation in NTU's extra-curricular activities are voluntary in nature and it has been found both from internal analysis and the wider literature that disadvantaged groups are often less likely to take up such opportunities (Kerrigan et al., 2018; May et al., 2011; McGowan et al., 2016). It is entirely possible, therefore, that any differing outcomes of participants illustrated by descriptive statistics are merely the result of a differential propensity to participate. By statistically controlling for and thus extracting the influence of these socio-economic and other effects, the use of logistic regression testing mitigates the possible effects of selection bias somewhat. However, we cannot eliminate the potential of hidden, unquantifiable and/or unknown self-selection effective (such as intrinsic motivation) influencing the findings. To this end, in the absence of randomly selecting participants to take part in what are fundamentally voluntary initiatives, we do not claim any causal associations between participation and

differential student outcomes. Nevertheless, the scale of this study is large (circa 30,000 participants across nine extra-curricular interventions), and adds to the growing evidence base relating to the relationship between student engagement and success.

Participants of all ECAs in the study were more likely to achieve higher average grade-based assessment (GBA) scores across all years of study (Figure 1). Taking NTU Sport as an example, which represents by far the highest number of students, 56% of year 1, 59% of year 2 and 68% of year 3 participants achieved average GBA scores equivalent to 2:1 or First Class. This compares with 49%, 52% and 62% respectively of all year 1, 2 and 3 UK domiciled NTU undergraduates respectively. On a purely descriptive level, therefore, it is clear that participants of extracurricular interventions at NTU achieved higher average assessment scores than non-participants.
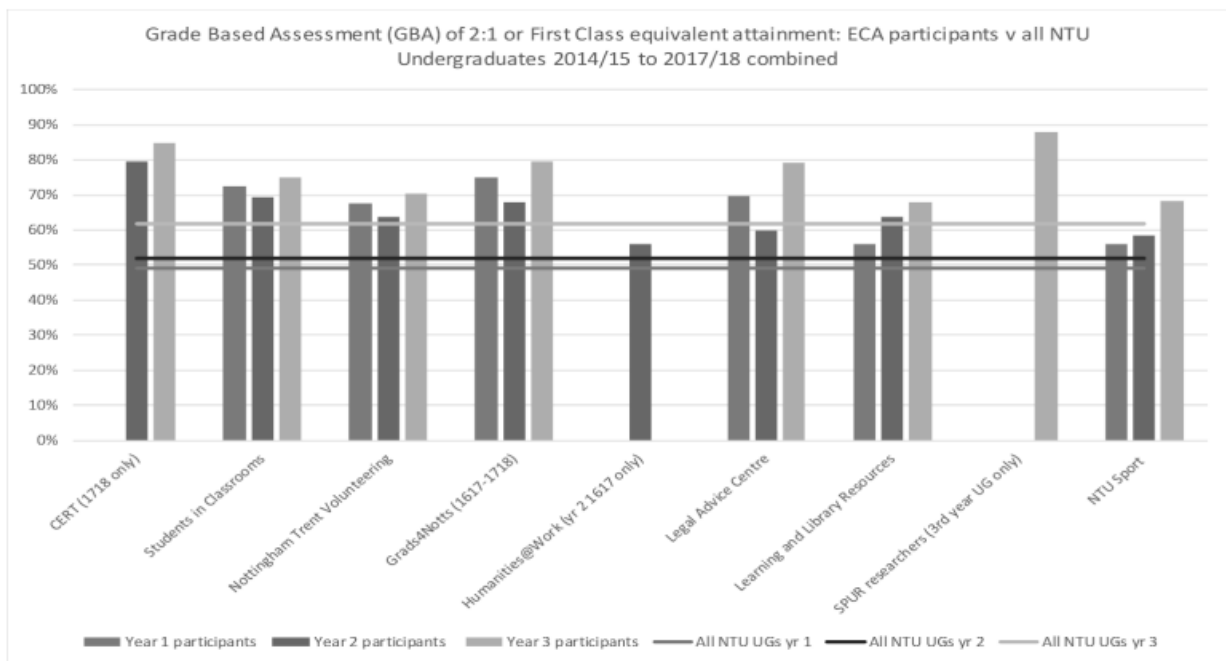
Results

Figure 3: Grade-based assessment equivalent to 2:1 or First Class, by year of study and type of extra-curricular

Research has demonstrated a strong correlation between preentry qualifications and undergraduate achievement; students with higher qualification tariffs are more likely to achieve higher degree outcomes than those with lower tariffs. The same applies to other groups known to have lower rates of success at NTU and the sector at large; black and minority ethnic (BME) students, disabled students, mature students and students entering via BTEC qualifications (HEFCE, 2014; HEFCE, 2018).vi It could therefore be the case that NTU's ECA participants had disproportionately high pre-entry tariffs and/or equality and diversity characteristics

known to influence success. However, even if this were the case, the higher attainment classifications amongst participants held across a range of pre-entry qualification tariffs and student groups. This is confirmed by statistical testing, a summary of which is shown in Table 1 below demonstrating strong evidence against the null hypothesis of no relationship between participation in extra-curricular activities and students' GBA scores, when controlling for other known (and available) influential factors, including gender, ethnicity, disability, age, subject area and pre-entry qualifications' Indeed, for all nine ESAs there was very strong evidence of a positive association between participation and higher attainment, with the greater 'effect sizes' apparently across SPUR, CERT and LAC, which reflects the descriptive trends shown in Figure 2.

Table 1: Extract from results of logistic regression of module

Independent variable	Regression co-efficient	Standard error	Odds ratio	p-value
CERT Mentoring (CERT)	1.16	0.13	3.19	<0.001
Grads 4 Nottingham (G4N)	0.72	0.23	2.05	0.002
Humanities at Work (HaW)	0.25	0.09	1.28	0.005
Libraries & Learning Resource (LLR)	0.44	0.06	1.55	<0.001
Legal Advice Centre (LAC)	1.09	0.12	2.97	<0.001
Nott'ham Trent Volunteer (NTV)	0.45	0.05	1.57	<0.001
SPUR researcher (SPUR)	1.19	0.26	3.29	<0.001
Students in Classrooms (SinC)	0.57	0.09	1.77	<0.001
NTU Sport	0.18	0.02	1.20	<0.001

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Chapter IV

DESIGNING LEARNING ENVIRONMENT FOR LIFELONG LEARNING IN THE EMERGING ECONOMIES

4.1. Designing virtual laboratories for Innovating STEM Education

In recent years, various new ideas have emerged in the field of education. While some of these concepts are new, others are a re-imagining of existing ideas in a new context. Some of the most relevant technological examples for this study include distance learning, e-learning, virtual laboratories, virtual reality, and virtual worlds, avatars, dynamics-based virtual systems, and the overall concept of immersive education that integrates many of these ideas together (Potkonjak et al., 2016). Several highly reputable institutions have gathered around this challenging concept, including the Immersive Education Initiative and the Immersive Learning Research Network iLRN. These topics and corresponding technologies can open the way to advanced education in STE disciplines. The concept of immersive education has been applied to all aspects of education, including formal-institutional education, informal massive education, and professional training in companies (Potkonjak et al., 2016).
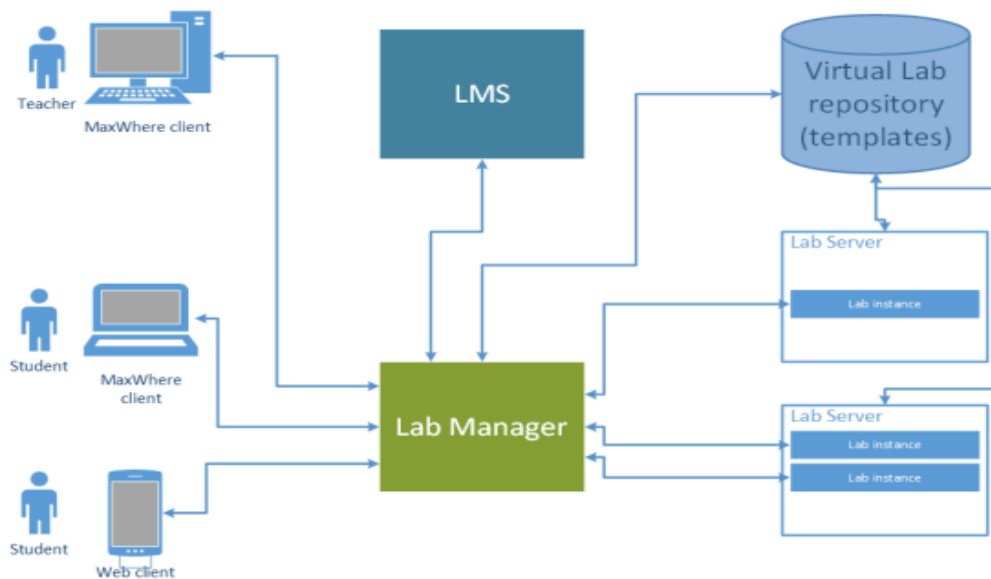

Figure 1
High level architecture of the virtual laboratory framework

Image Source: (Budai & Kuczmann, 2018).

According to Hernandez-de-Menendez et al., (2020), between 2023 and 2028, Virtual and Augmented Reality (VAR) will become widely utilized in the field of education, driven by advancements in mobile device design and capabilities, as well as increased investment in technological development. VAR's interactive and innovative features provide students with

enhanced engagement and motivation towards their coursework. Additionally, research suggests that VAR may enhance academic performance and foster the development of social, collaborative, psychomotor, and cognitive skills (Hernandez-de-Menendez et al., 2020).

Although many universities have adopted virtual labs, the adoption rates and usage remain relatively low, prompting further research to incorporate sensory features such as touch and olfaction to create a more realistic virtual experience. The picture adapted from Potkonjak et al., (2016) shows list of virtual lab projects with specifications in different institutions across the world. Augmented and virtual reality technologies will be leveraged in the creation of virtual labs, where students on-site and in the form of avatars can communicate and interact with each other (Hernandez-de-Menendez et al., 2020). As technology advances, virtual labs may replace traditional labs due to their increasing realism, with not just engineering disciplines but also biology and other fields incorporating this technology to access its numerous benefits.

Table 1
List of virtual lab projects with specifications.

Project	Coordinating institution	Field	C1	C2	C3	C4	Funding
LiLa	University of Stuttgart, Germany	General initiative	—	—	—	—	European Commission
Go-Lab Project	University of Twente, Netherlands	General initiative	—	—	—	—	European Commission
VccSSe	Valahia University of Targoviste, Romania	Physics	yes	yes	no	no	European Commission
TEALsim	Massachusetts Institute of Technology, USA	Physics	yes	yes	yes	no	National Science Foundation, Davis Educational Foundation
Ironmaking	RWTH Aachen University, Germany	Process Technology	yes	yes	no	no	University research
The Virtual CVD Learning Platform	Oregon State University, USA	Process Technology	yes	no	yes	partly	University research
Virtual laboratory of process control	Slovak University of Technology, Bratislava	Engineering – non robotic	yes	yes	no	no	University research
Multiplatform Virtual Laboratory for educational purposes	Universitat Politècnica de Catalunya, Spain	Engineering – non robotic	yes	yes	no	no	University research
TriLab	Loughborough University, UK	Engineering – non robotic	yes	yes	no	no	University research
Virtual Electric Machine Laboratory	Firat University, Turkey	Engineering – non robotic	yes	yes	no	no	University research
Virtual Laboratory Environment	Stevens Institute of Technology, USA	Engineering – non robotic	yes	yes	yes	yes	University research
RoboUALab	University of Alicante, Spain	Robotics	yes	yes	yes	partly	University research
Virtual Laboratory for Mobile Robotics	Department of Computer Science, Tecnológico de Monterrey, Mexico	Robotics	yes	no	yes	no	University research
ROBOMOSP	Pontificia Javeriana University, Colombia	Robotics	yes	yes	yes	no	University research
VCIMLAB	Eastern Mediterranean University, Cyprus	Robotics	yes	no	yes	partly	University research
VirtualRobot	Polytechnic University of Valencia, Spain	Robotics	yes	yes	yes	partly	University research
VLR	School of Electrical Engineering, University of Belgrade, Serbia	Robotics	yes	yes	yes	no	University research
USARSim	University of Pittsburgh, USA	Robotics	yes	no	yes	yes	National Institute of Standards and Technology, USA
COSIMIR	University of Dortmund, Germany	Robotics	yes	yes	yes	partly	commercial
RoboLogix	Logic Design Inc., Canada	Robotics	yes	yes	yes	partly	commercial

NOTE: There are some important remarks concerning the scores of considered laboratories and their potential applications. One should understand that the relevance of some criterion depends on the foreseen application. Let us illustrate this by an example. Suppose a user is interested in training of robot operators/programmers. In such case, the dynamics of the robot is irrelevant while kinematics, i.e. the robot motion according to the input program, is of major importance. The interfaces that precisely emulate the real systems are also of high relevance. Suppose now that the same lab is used to teach the theory of robotic systems, with the idea that students understand how a robot works. In this case, the interface is mainly irrelevant while the correct dynamic behavior is of prime importance. In order to create a widely applicable and user-friendly laboratory, developers must take care of these facts.

Source: (*Potkonjak et al., 2016*)

Table 1

Advantages and drawbacks of virtual laboratories

Advantages	Drawbacks
Cost efficiency for educational institutions	High computer resource requirements
Flexibility to create different experiments	Lack of seriousness, responsibility and carefulness among students
Multiple student access to virtual equipment	Virtual systems may not provide the same level of realism as physical labs
Ability to modify parameters that cannot be changed in physical systems	Final stage of training often requires hands-on experience with real equipment
Damage resistance allows for learning from mistakes	
Ability to remove covers and reveal inner structures	

Adapted from (Potkonjak et al., 2016)

Below are some images of the virtual labs in the Science, Engineering and Technology disciplines. Figures are directly adapted from *(Potkonjak et al., 2016)*

Fig. 1. The Virtual CVD Learning Platform (Koretsky et al., 2008). Figure shows loading of wafers into a CVD furnace within 3D graphical user interface.
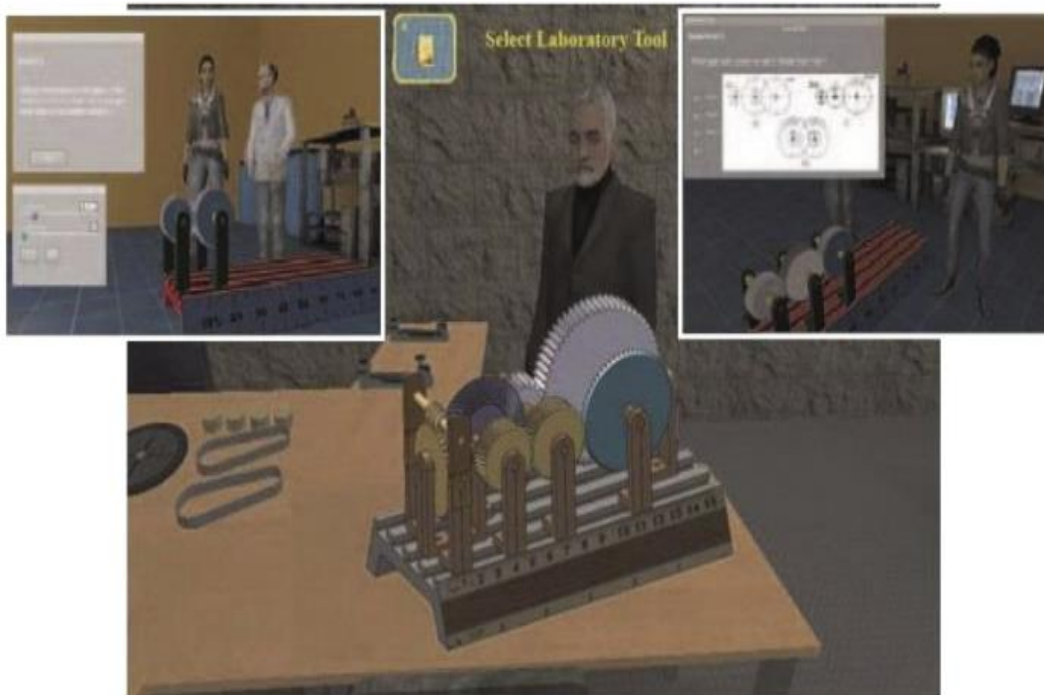
Fig. 2. Virtual laboratory at Stevens Institute of Technology (Aziz et al., 2009; Aziz et al., 2014). Good example of the realization of all four criteria defined in Section 3.
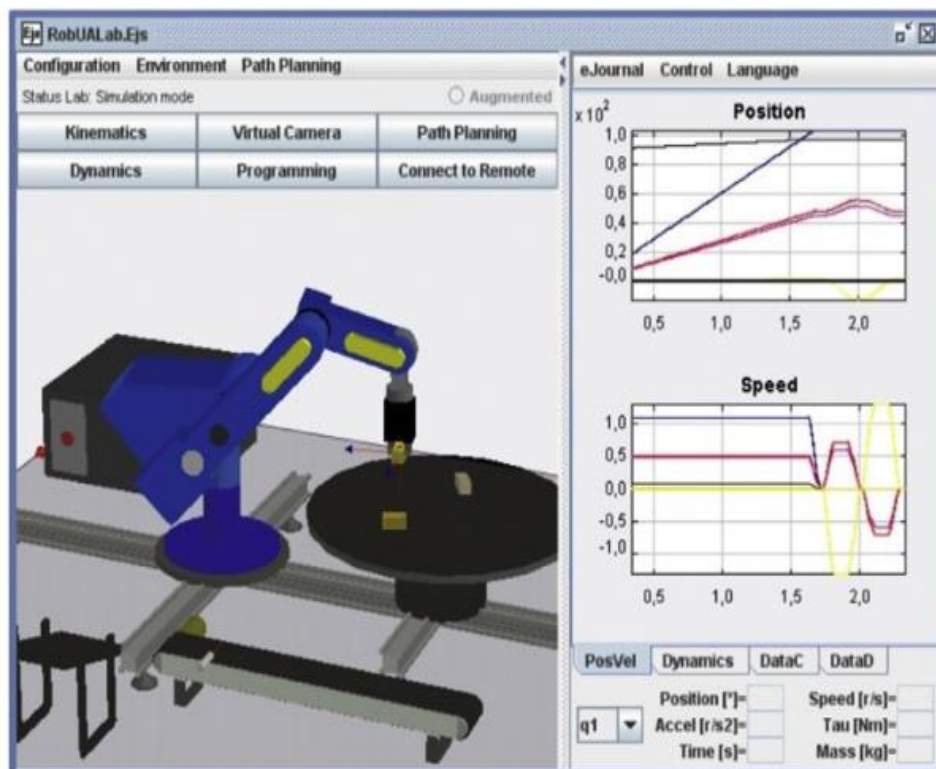

Fig. 3. RoboUALab (Jara et al., 2011; Torres et al., 2006). Besides graphical interface, figure shows very important feature of real-time data presentation.
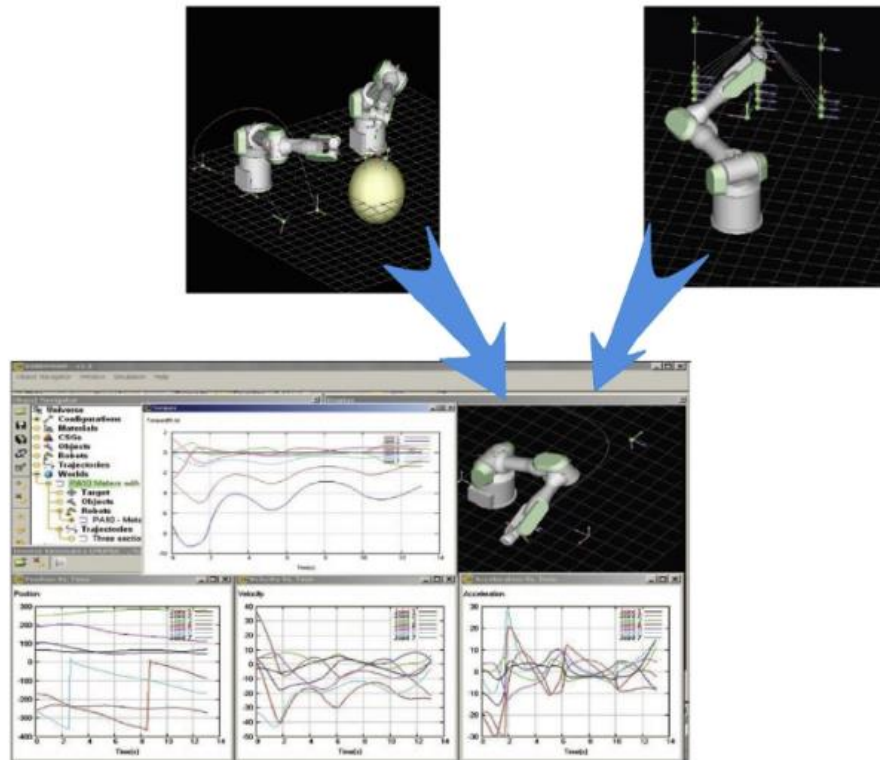
Fig. 4. ROBOMOSP (Jaramillo-Botero et al., 2006). Figure shows robotic manipulator executing desired task, as well as appropriate data considering robot kinematics and dynamics.
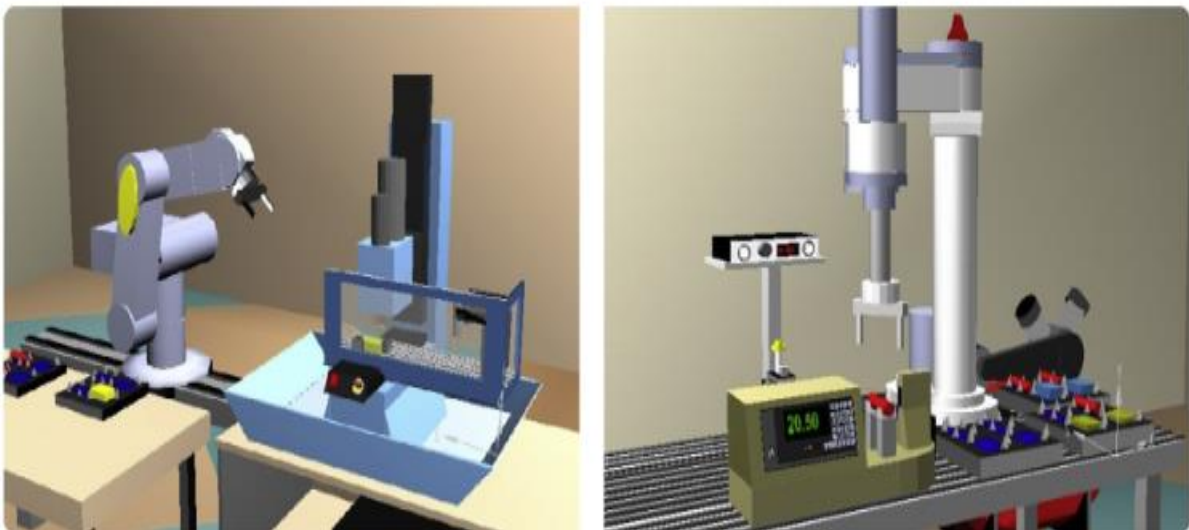

Fig. 5. VCIMLAB (Hashemipour et al., 2011). Automated production system presents virtual replica of the real CIM laboratory.

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(a)

ETF jointed configuration

(external view of the robot)

(b)

Reveling the inner structure
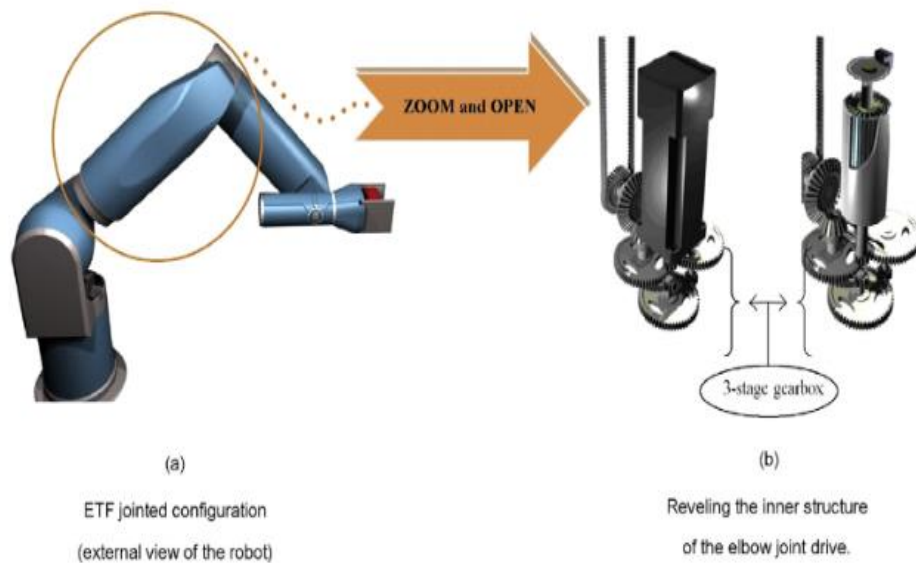
of the elbow joint drive.

Fig. 6. VLR at ETF (Potkonjak et al., 2010; Potkonjak, Jovanovic, Petrovic, et al., 2013. Reveling of the inner structure, shown on the right, can be extremely useful for deeper understanding of mechanism principles.
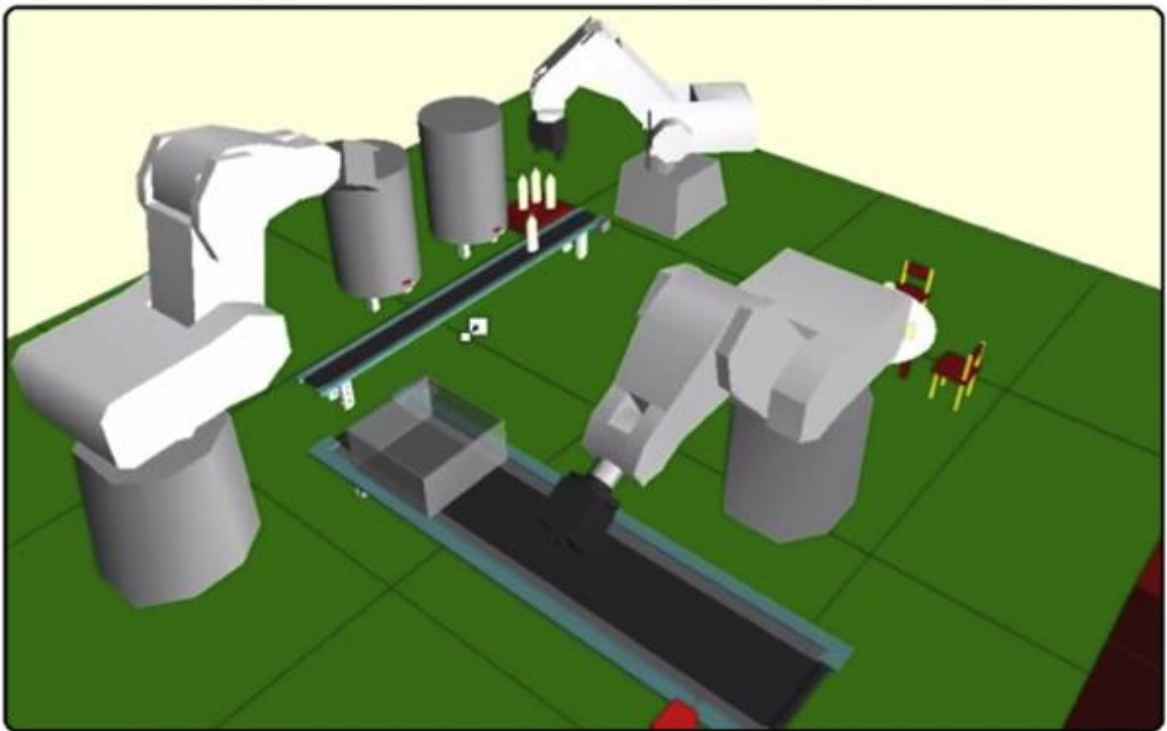

Fig. 7. COSIMIR (Freund & Pensky, 2002). Figure shows cooperation between three robots.

Fig. 8. RoboLogix (http://www.robologix.com). Graphical simulation of "real life scenario", robot working in production line.

4.2. Mobile learning for empowerment and productivity

The appetite for mobile learning has grown into a consistent growl over the past eight or so years, now reaching a point where it's no longer a nice-to-have, but instead, a must-have. The benefits of mobile learning (m-learning) are well-known for organizations both big and small, especially as it relates to improved knowledge retention and increased employee engagement.

NEED PROOF MOBILE LEARNING WILL BE CORE TO GUIDING YOUR LEARNING ACTIVITIES OF THE FUTURE?

64% Of learners find accessing their training content from a mobile device essential

43% Of learners see improved productivity levels compared to non-mobile users

89% Of smartphone users download apps, 50% of which are used for learning

46% Of learners use mobile learning before they go to sleep at night

27% The number of mobile-only users (27%) has grown, now surpassing desktop-only users (14%)

71% Of Millennials say they connect more with mobile learning than L&D activities delivered via desktop or formal methods

2,600 The average person spends 2 hours and 51 minutes on their smartphone each day, looking at it roughly 221 times and touching its screen more than 2,600 times

45% Smartphone learners complete course material 45% faster than those using a computer

Source: Docebo (2019)

The global mobile learning market size is expected to reach USD 617.63 Billion in 2030 and register a revenue CAGR of 32.0% over the forecast period, according to the latest report by Reports and Data (https://techbullion.com/mobile-learning-market-size-to-reach-usd-617-63-billion-in-2030/). The rising demand for e-learning in educational institutes is driving mobile learning market revenue growth. Likewise, the mobile learning market is set to grow from its current market value of more than $20 billion to $55 billion-plus by 2026, according to the latest study by Global Market Insights, Inc.

(https://www.reportlinker.com/p06319496/Mobile-Learning-Global-Market-Report.html?utm_source=GNW)
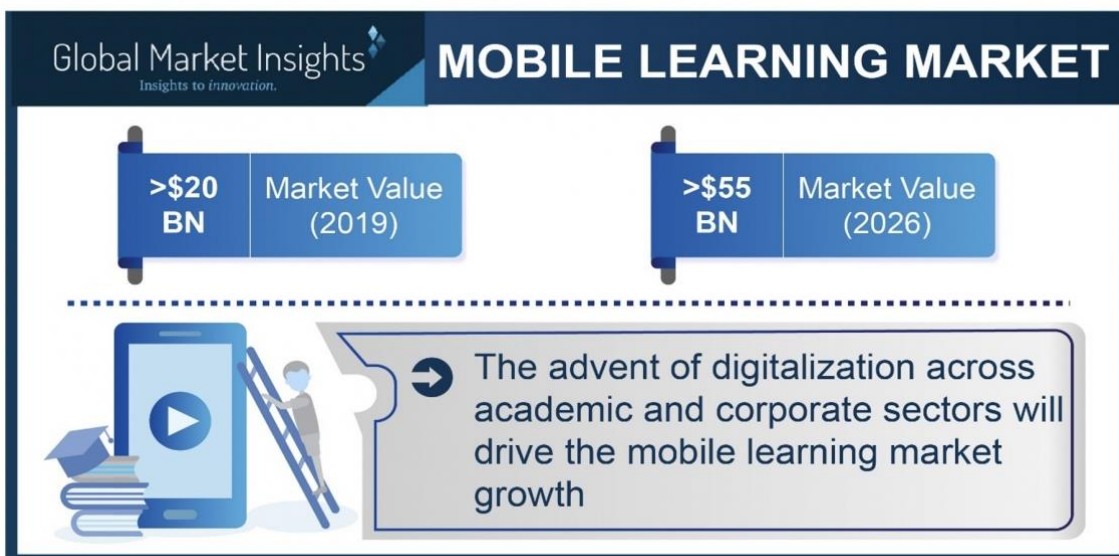
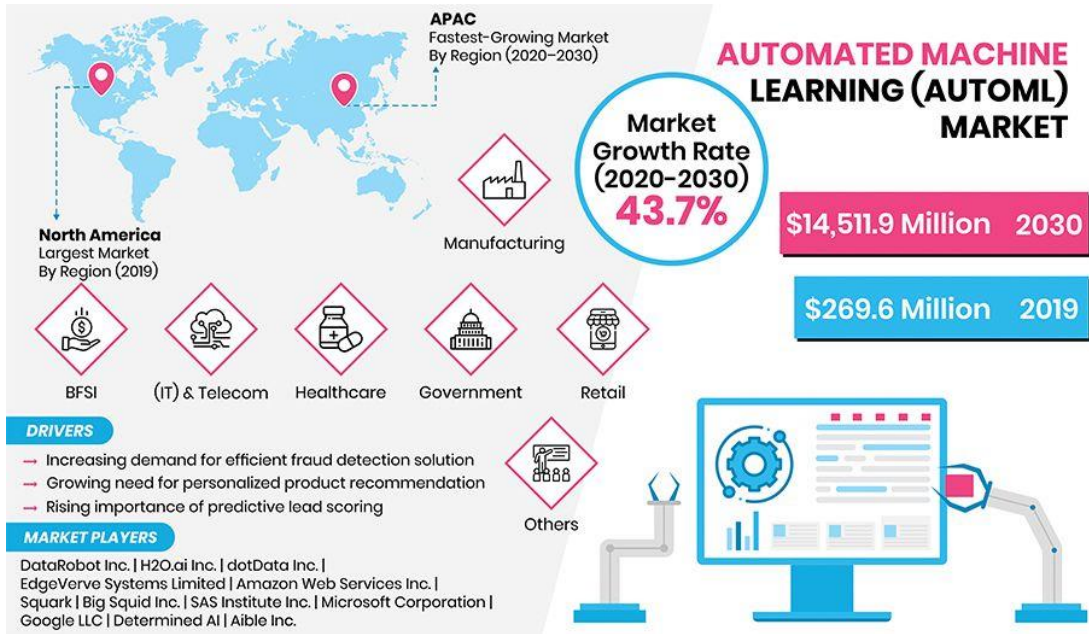Solution Outlook (Revenue, USD Million; 2018–2030)

- E-Books
- Audio-Visual Course Contents
- Portable Learning Management system
- Interactive Assessments
- Content Development
- m-Enablement

Application Outlook (Revenue, USD Million; 2018–2030)

- Simulation-Based Learning
- Corporate Training
- Online On-The-Job Training
- In-Class Learning

4.3. Automated Machine Learning

The automated machine learning market is being propelled by the increasing demand for solutions that can efficiently detect frauds, rising requirement for personalized product recommendations, and surging awareness about the benefits of predictive lead scoring. As a result, the sale of such solutions will generate $14,511.9 million by 2030, compared to $269.6 million in 2019; the industry is set to experience a massive 43.7% CAGR during 2020–2030.

AUTOMATED MACHINE LEARNING (AUTOML) MARKET

APAC
Fastest-Growing Market
By Region (2020-2030)

North America
Largest Market
By Region (2019)

Market Growth Rate (2020-2030)
43.7%

Manufacturing

$14,511.9 Million 2030

$269.6 Million 2019

BFSI (IT) & Telecom Healthcare Government Retail

Others

DRIVERS
→ Increasing demand for efficient fraud detection solution
→ Growing need for personalized product recommendation
→ Rising importance of predictive lead scoring

MARKET PLAYERS
DataRobot Inc. | H2O.ai Inc. | dotData Inc. |
EdgeVerve Systems Limited | Amazon Web Services Inc. |
Squark | Big Squid Inc. | SAS Institute Inc. | Microsoft Corporation |
Google LLC | Determined AI | Aible Inc.

4.4. MOOCs in lifelong learning- TODAY vs TOMORROW

Online schools offering MOOC:

udemy UDACITY coursera edX

Where do MOOC students live?

US – 30% UK – 11% India – 7% Brazil – 5%

36% of non-MOOC students plan to join the club!

Why is that?

Cost savings

Nice company online

Quality learning content

Nice prospects and increasing adoption

Just the fun of it!

65% of the global population can't afford paid tuition. 4.8B potential MOOC learners!

Downside: 70% fail to complete the course. No expenses—no motivation??

Is MOOC for the unemployed?

Turns out it's not!

- 50% - Full Time Employment (FTE)
- 18% - Students (STU)
- 13% - Unemployed/Retired (UNEMPL/RET)
- 13% - Self-employed (SE)
- 6% - Part-timers (PTE)

Who's funding MOOC?

Global tech and edu companies on the sponsor list: Google, AT&T, Microsoft, Coursera, Lynda.com, Harward University.

Google   AT&T   Microsoft

coursera   lynda.com   HARVARD

Market Research

- $ 2B in 2016 → $8.5B in 2020!
- Compound annual growth rate (CAGR) of 36.0%
- FREE education = a thriving market segment

What the future holds?   MOOC 2020 Forecast:

- 12M students worldwide
- China opens up for MOOC in full scale!
- Completion rate rises to 50%
- 80% MOOC students are not from the US
- Employment pie re-shuffle:
  FTE = 29%
  PTE = 17%
  SE = 20%
  STU = 22%
  UNEMPL/RET = 12%
- 50% start MOOC out of curiosity among other reasons

Source: (Winstead, 2022)

Why student drop out in MOOC's
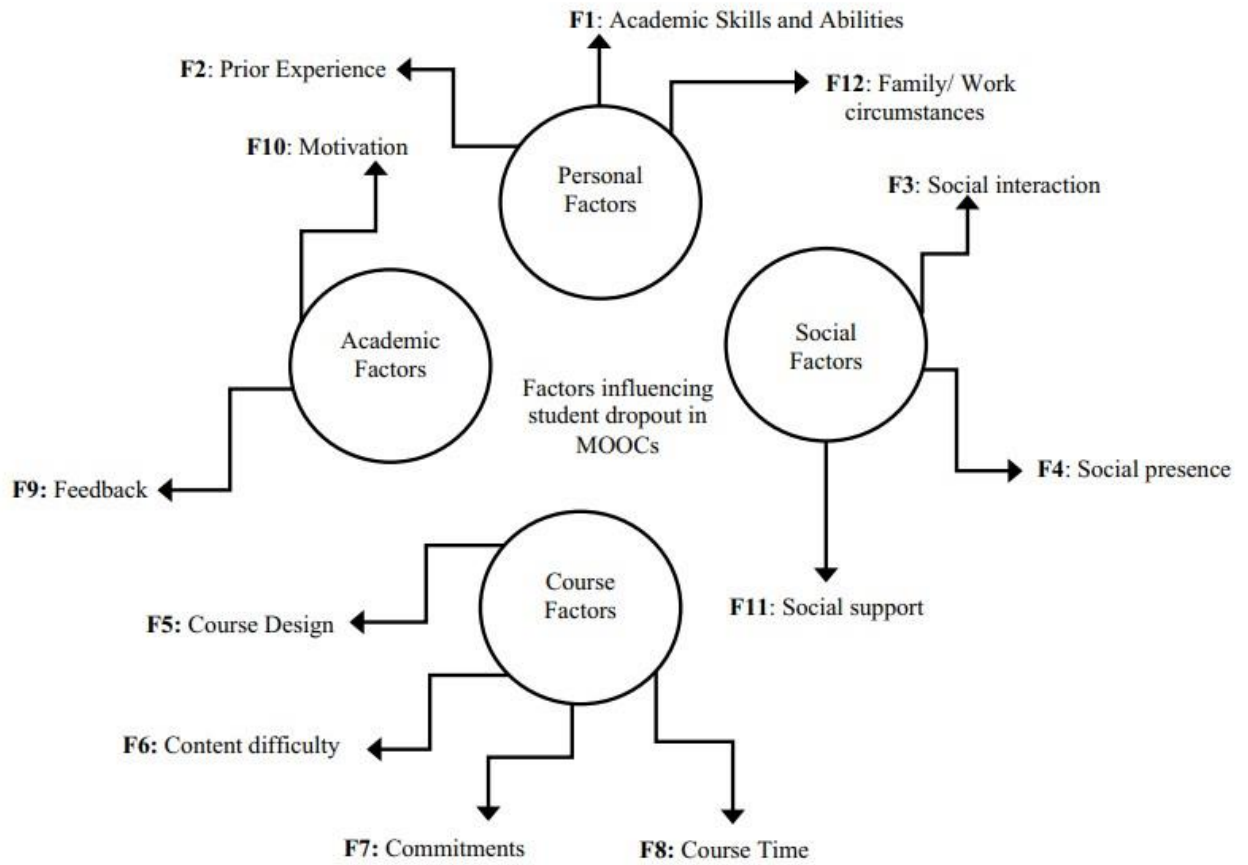
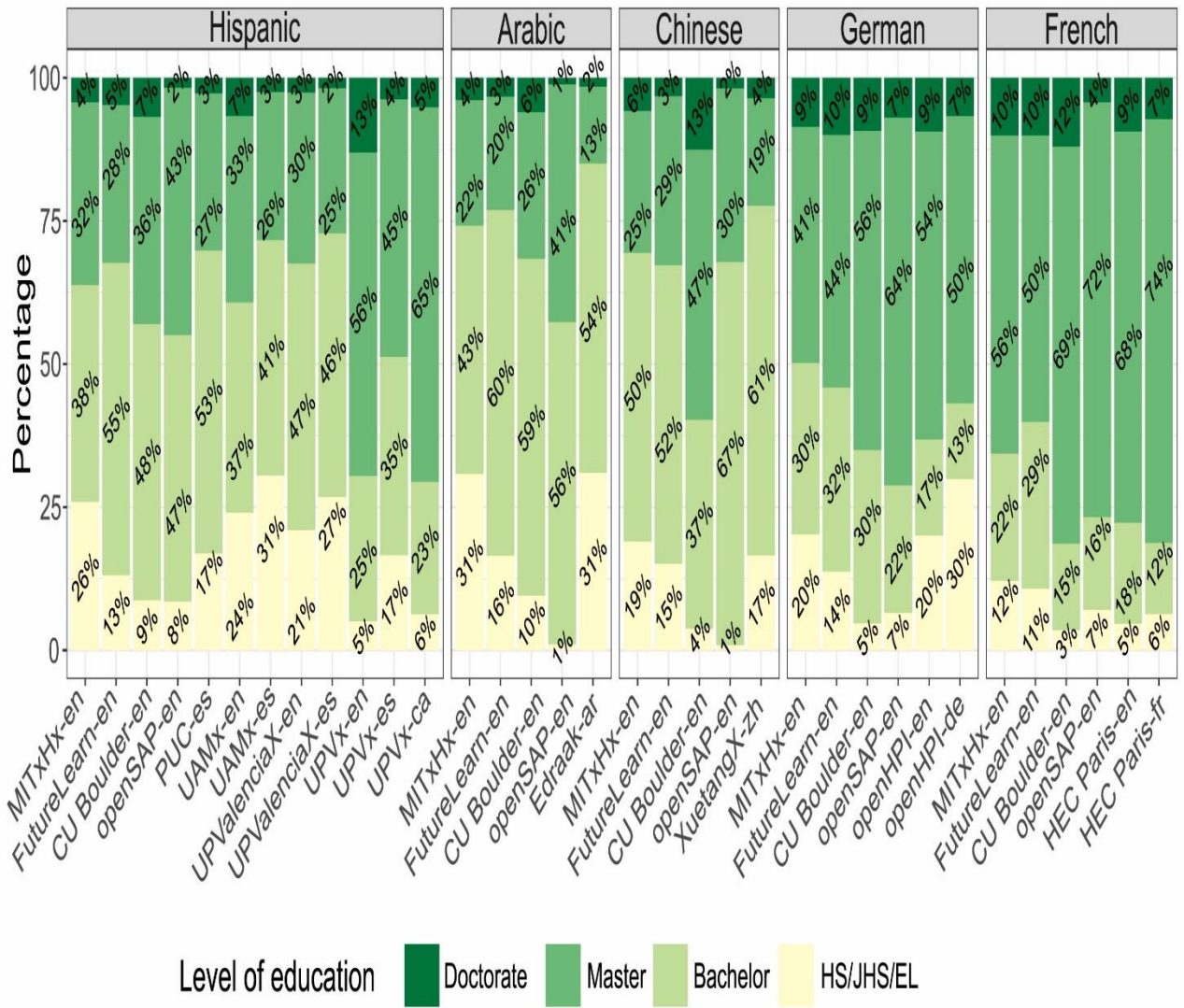**Fig. 1** An illustration of factors influencing student dropout in MOOCs

(Aldowah et al., 2020)
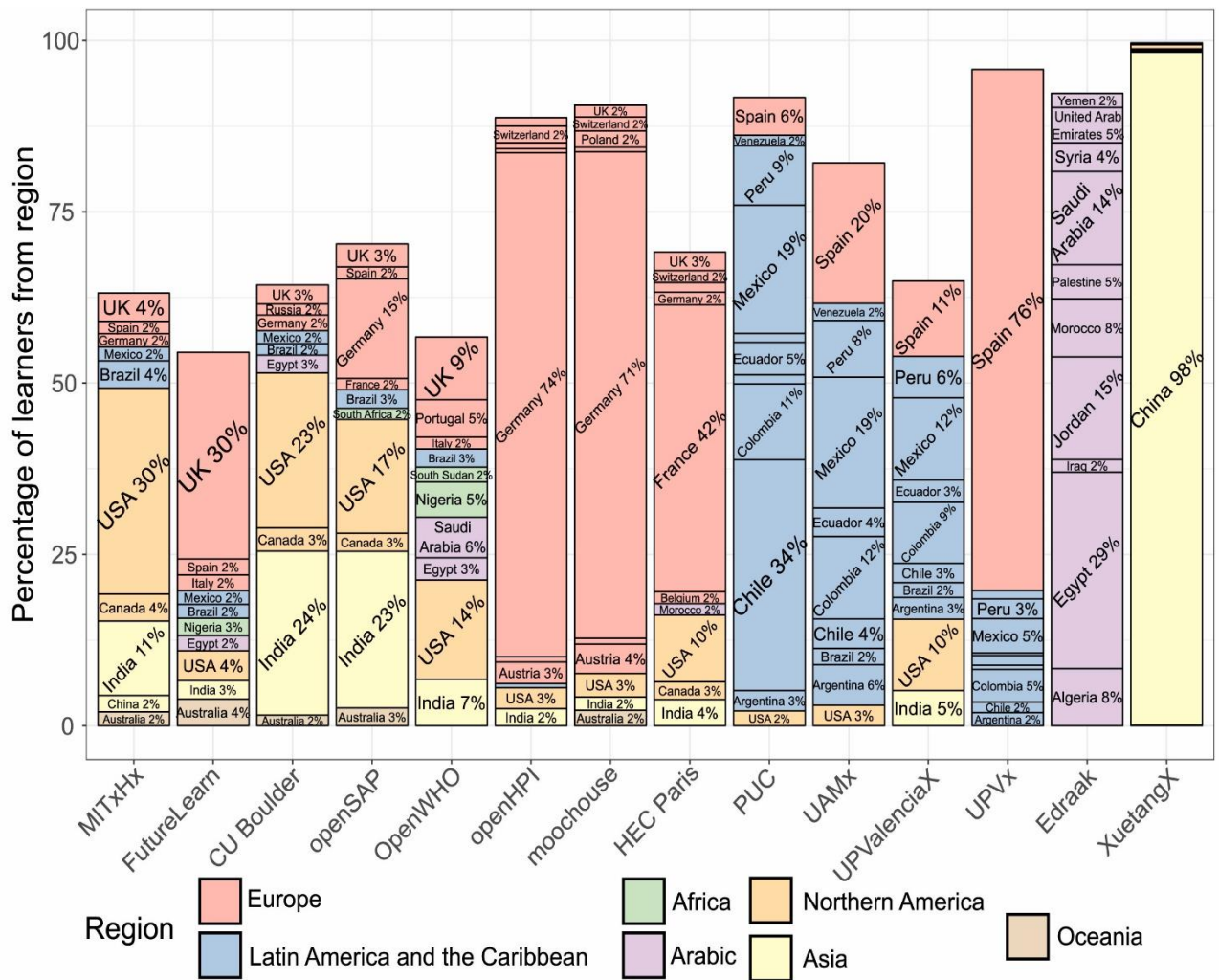
Source: (Ruipérez-Valiente et al., 2022)
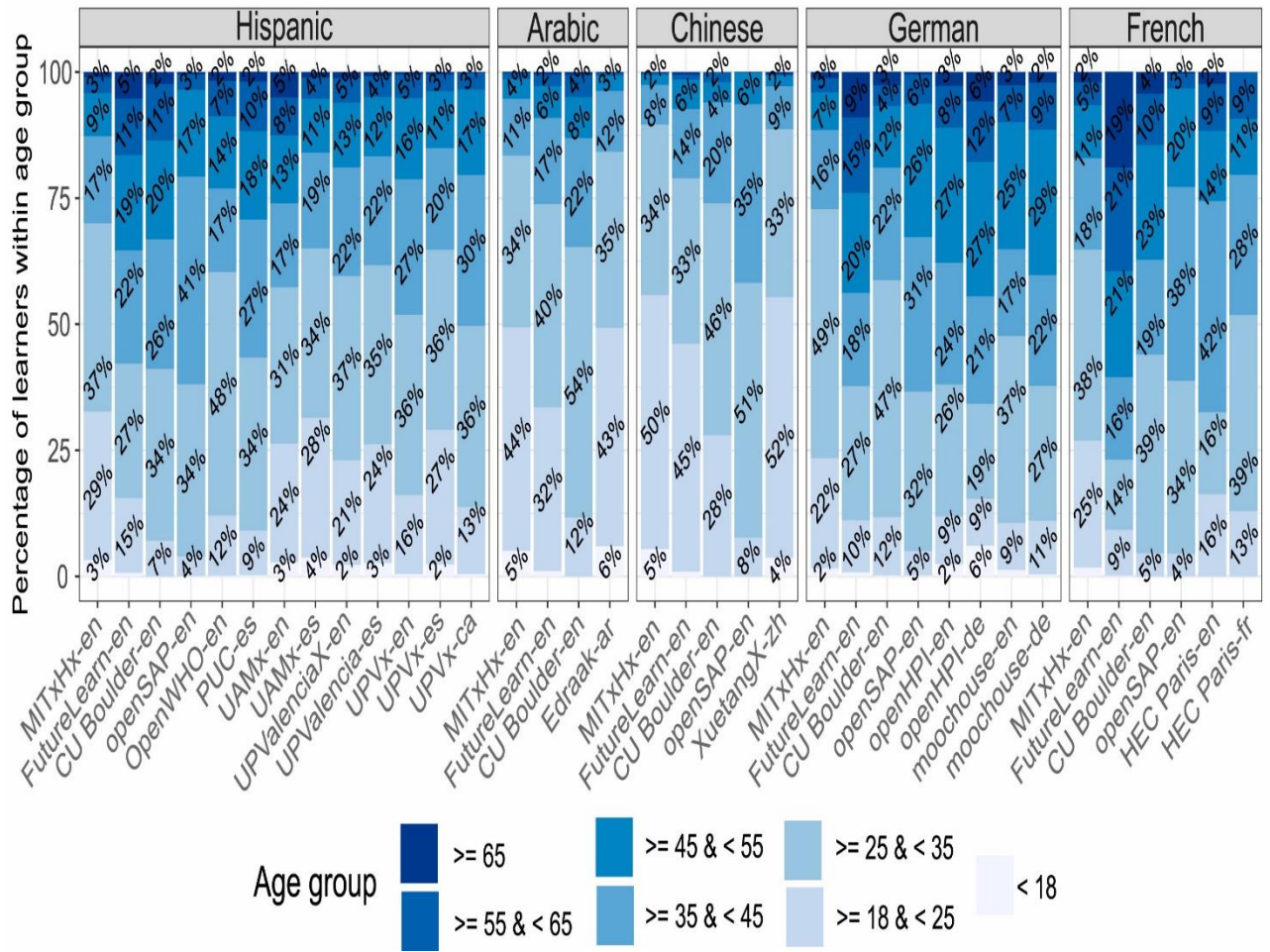
Source: (Ruipérez-Valiente et al., 2022)

**Source:** (Ruipérez-Valiente et al., 2022)

CHAPTER V

OPPORTUNITIES OF APPLYING VIRTUAL LEARNING TECHNOLOGIES IN LIFELONG LEARNING

5.1. Developing interactivity in higher education

Interactivity is an important factor in modern education. It refers to the dynamic exchange of information between people, tools and technology. In higher education, interactivity brings about a great impact on learning effectiveness and student engagement. Interactivity in higher education has many benefits. It helps to enhance student engagement and increase student participation in learning. It also encourages critical thinking, allowing students to explore different perspectives and deepen their understanding of the topics. Additionally, interactivity enriches the learning experience, making it more engaging and enjoyable. There are several ways to develop interactivity in higher education. Incorporating interactive technologies, such as virtual reality and augmented reality, can offer students a more immersive and engaging learning experience. Group activities can also be used to create a more interactive learning environment, allowing students to collaborate and discuss. Establishing active learning environment, such as flipped classrooms, also allows students to be more interactive and engaged in the learning process.

5.2. Facilitation of students' engagement

Interactivity in higher education is an important component for increasing student engagement. Innovation can create Interactivity and take many forms and used in various ways to support learning, such as through the use of technology, collaborative activities, and active learning. Technology, such as online discussion boards, can be used to facilitate student interaction and discussion. Through the use of these tools, students are able to receive feedback and engage in meaningful dialogue. Additionally, collaborative activities, such as group projects, can be used to foster collaboration and interaction among students. This type of activity encourages students to work together to solve problems and come up with solutions. Finally, active learning activities, such as simulations and role-playing, can be used to help students develop their critical thinking skills.
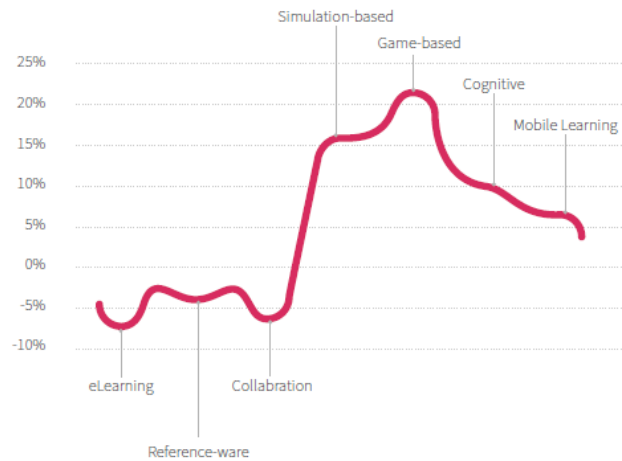
Meanwhile, as Millennial and Generation-Z aged employees infiltrate the organizational ranks, decision-makers are recognizing an importance on the development of soft skills, especially as it relates to softening the impact of automation. According to LinkedIn Learning's 2018 Workplace Learning Report, training for soft skills is a top priority to mitigate the pace of technological change, which demands adaptable, critical thinkers, communicators and leaders.

By providing students with opportunities to practice and apply their knowledge, these activities can increase engagement and understanding. Interactivity in higher education can also be used to help create a more engaging learning environment. By utilizing technology, such as video conferencing and virtual classrooms, teachers can create a more interactive learning environment that allows for greater student participation and engagement. Additionally, teachers can use various tools, such as discussion boards and interactive whiteboards, to facilitate student collaboration and engagement.

Use of technology in the classroom,[1] % of respondents (n = 1,452) — Prepandemic — During pandemic[2]
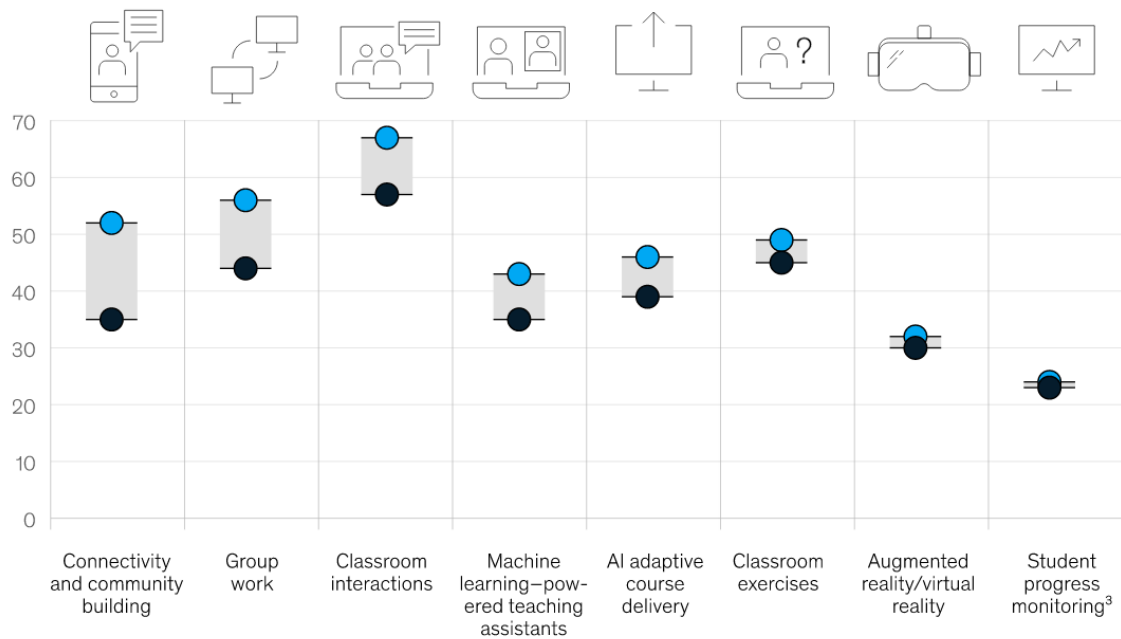
Source: McKinsey Company (2022).

Finally, teachers can use active learning activities, such as debates and simulations, to help students develop their critical thinking skills and increase their engagement in the learning process. Overall, interactivity in higher education can be a powerful tool for increasing student engagement and learning. By utilizing technology, collaborative activities, and active learning activities, teachers can create a more engaging learning environment that encourages student participation and understanding. Through the use of these tools, teachers can help foster student interaction and collaboration and help students develop their critical thinking skills.

5.3. Easiness in the management process

Technology-based teaching can be used to create an interactive learning environment that encourages active participation of students in the learning process. This can be accomplished through virtual classrooms, online lectures and video tutorials, and e-learning platforms. Technology can also be used to create a collaborative learning environment that allows students to share their knowledge and experiences with each other. Furthermore, technology can be used to create a personalized learning experience with customized content and resources tailored to the individual student's needs. Finally, technology can be used to streamline the management process of the innovation education program by automating administrative tasks and providing data-driven insights into the effectiveness of the program. In conclusion, technology can be

used to make the management of innovation education for lifelong learning easier and more efficient. Technology-based teaching and learning can help to create an interactive and collaborative learning experience for students. technology can be used to automate the administrative tasks associated with the program, as well as provide data-driven insights into the effectiveness of the program.

The management process is relatively simple and straightforward. The first step is to identify the desired outcome and objectives of the program. Once these have been established, the next step is to develop a curriculum that meets the learner's needs and interests. This can be done by consulting with experts in the field and researching available courses and seminars. After the curriculum has been finalized, the program can then be implemented. Innovation is beneficial for individuals of all ages and backgrounds. It is an effective way for learners to explore their interests and develop their skills in a variety of areas. Additionally, it can also provide individuals with the opportunity to gain a competitive edge in the job market. Because of the flexibility and ease of management of the program, this form of education is becoming increasingly popular for those who wish to further their education.

CHAPTER VI

INNOVATIVE EDUCATIONAL TECHNOLOGIES FOR LIFELONG LEARNING

6.1. Adaptive learning platforms

Developing adaptive learning platforms that cater to the unique learning styles, goals, and preferences of individual students. In summary, adaptive learning technology is a powerful tool that can help you to deliver personalized, engaging, and effective learning experiences. By using AI and real-time data analytics, you can tailor your content to the needs of each individual learner which leads to higher engagement, retention, and achievement. As well as, it is possible to track lifelong learners' progress, and provide targeted support where needed.

Another benefit of this adaptive learning platform is that it allows you to monitor learner progress in real-time. You can view detailed reports that show how each learner is performing, identify areas where they need additional support, and adjust your course materials accordingly. This helps you to deliver a more effective and efficient learning experience, as you can respond quickly to any issues that learners may be facing.

Additionally, the platform offers a range of interactive features that help to keep learners engaged and motivated. These include multimedia content, interactive quizzes, and gamification elements such as badges and leaderboards. By making learning more fun and engaging, learners are more likely to stay motivated and focused on their educational goals.

The software is compatible with both Android and Apple devices while remaining perfectly formatted within any computer-based web browser. This gives you total flexibility when it comes to lesson delivery.

EddApp

EdApp is an adaptive learning platform that's packed with features including Brain Boost. Brain Boost, EddApp's spaced repetition tool, eliminates the issue of knowledge retention. With automatic, personalized follow-up tests, Brain Boost enables learners to retain new

information better. It will question them on the items they got in a course but will focus more on the ones they got incorrect. The activities are personalized for each student and each session's schedule and content are determined by the individual and the responses they supplied in prior sessions.
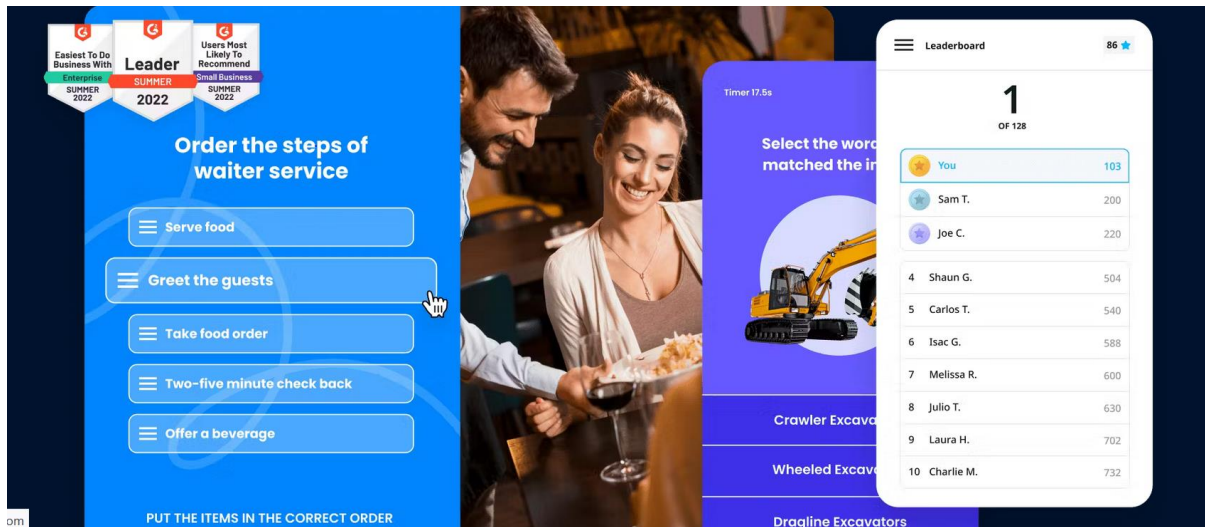
6.2. Gamification.

Gamifying learning content to make the learning process more engaging, fun, and satisfying. The gamification market size is predicted to register an impressive growth rate of 27.4%, reaching $30.7 billion by 2025 (https://financesonline.com/gamification-statistics/).
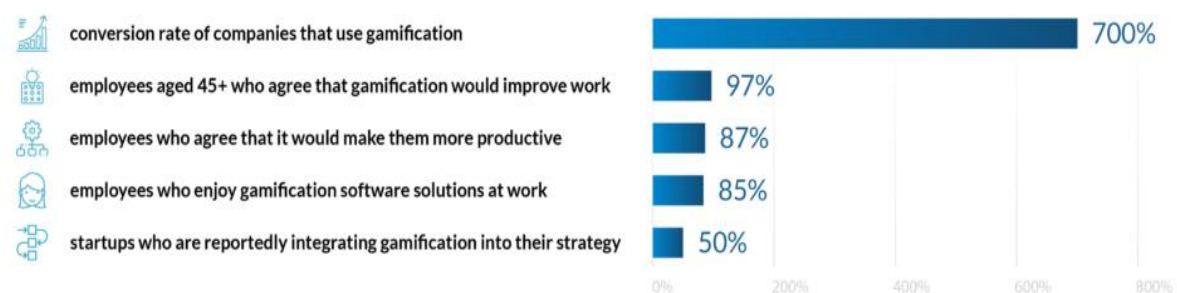
1 Gamification in training

Sources: eLearning Learning, EHSToday

80% US workers who believe game-based learning is more engaging

60% increase in employee engagement as a result of gamification training features

50% improved productivity because of gamification training features

50% business transformation programs that fail due to poor employee engagement

2 Gamification in operations

Sources: Medium, Talent LMS, Neil Patel, Bitcatcha

conversion rate of companies that use gamification	700%
employees aged 45+ who agree that gamification would improve work	97%
employees who agree that it would make them more productive	87%
employees who enjoy gamification software solutions at work	85%
startups who are reportedly integrating gamification into their strategy	50%

3 Preferred gamification strategies of adult learners

Source: Bravon

| progressing to different levels	getting points/scores	receiving real-time performance feedback	progress bars	activity feeds	competing with friends	being part of a story	avatars	virtual currencies
30%	27%	26%	25%	24%	13%	11%	3%	2%
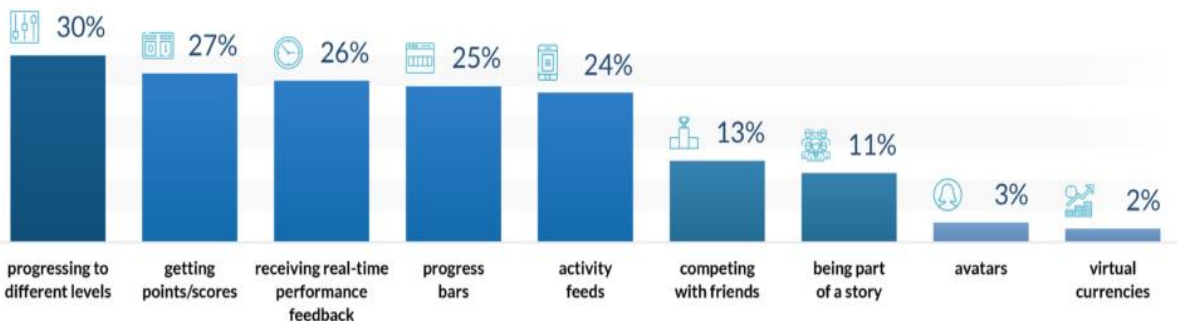
Gamification is a technique that has gained recognition in recent years as an effective and engaging way to enhance lifelong learning. The method involves incorporating game elements into the learning process, encouraging learners to engage with the content more deeply and resulting in increased participation and motivation.

One successful example of gamification in lifelong learning is Duolingo, a language-learning app that gamifies the process of mastering a new language. The app incorporates points, badges, and leaderboards to motivate learners to complete more lessons and improve their skills. With over 300 million registered users, Duolingo has proven that gamification can be an effective way to enhance the learning experience.
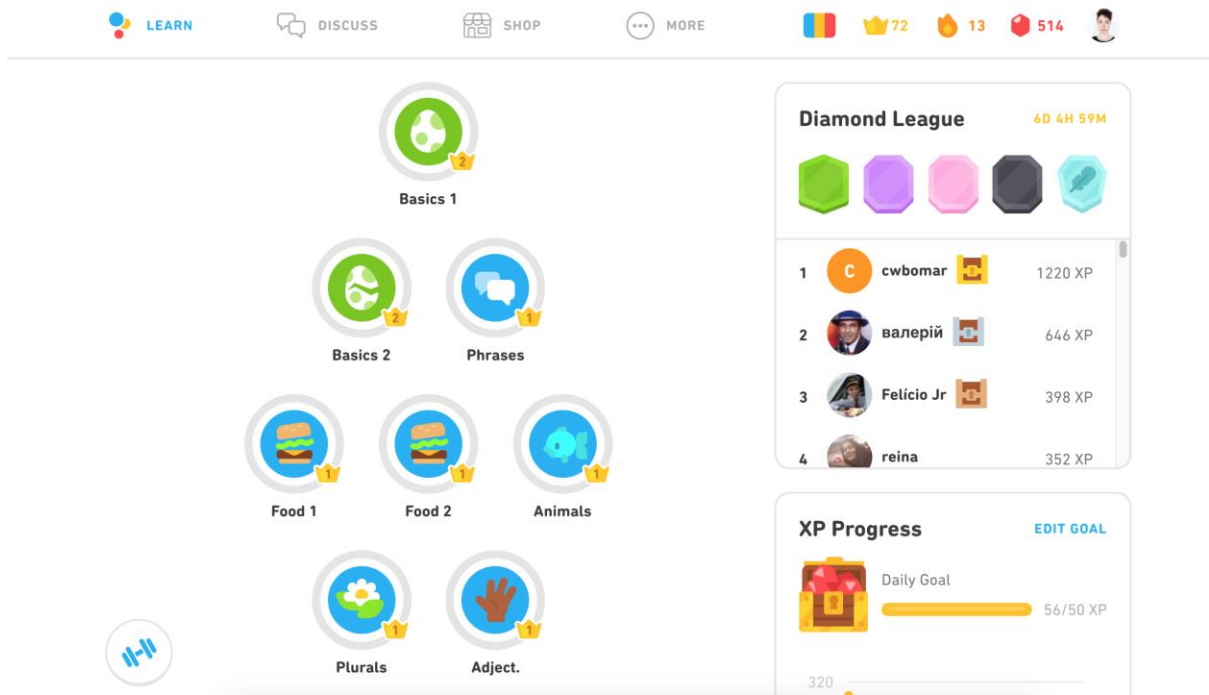
Another application is **_Padlet_** which can be used for storytelling and gamification among learners. The learners can easily access anywhere, anytime.
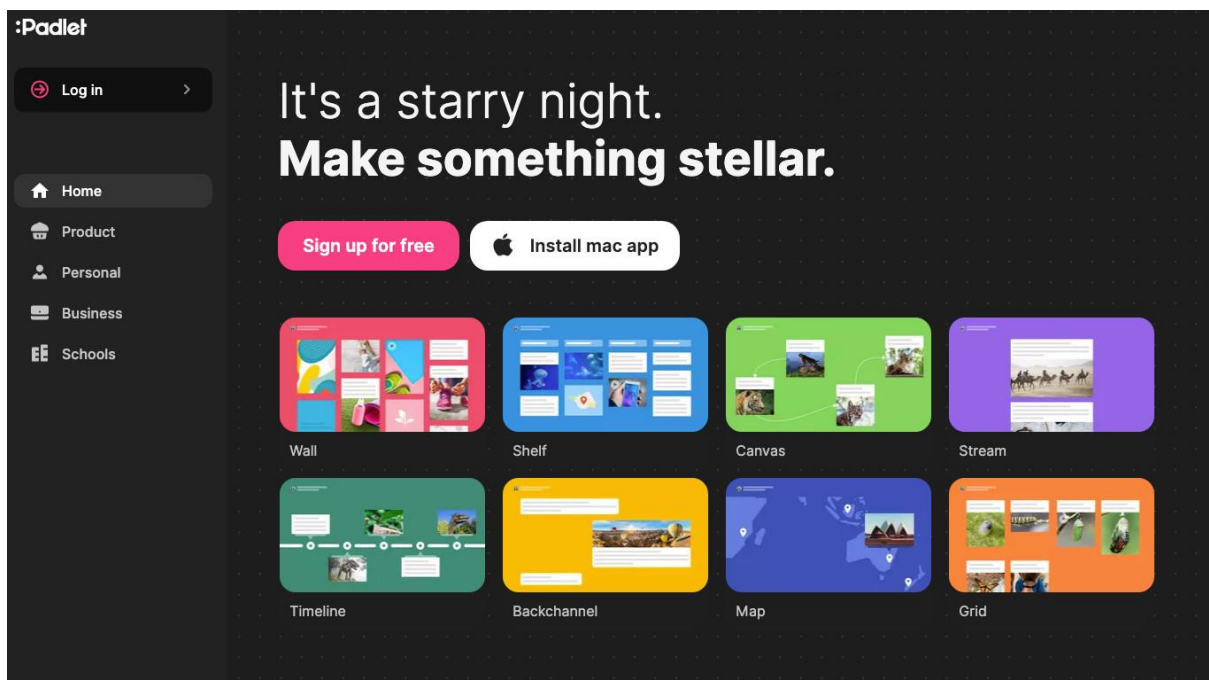
6. Personalization. Using technology and data analysis to provide personalized learning experiences based on each student's unique goals, interests, and learning styles.
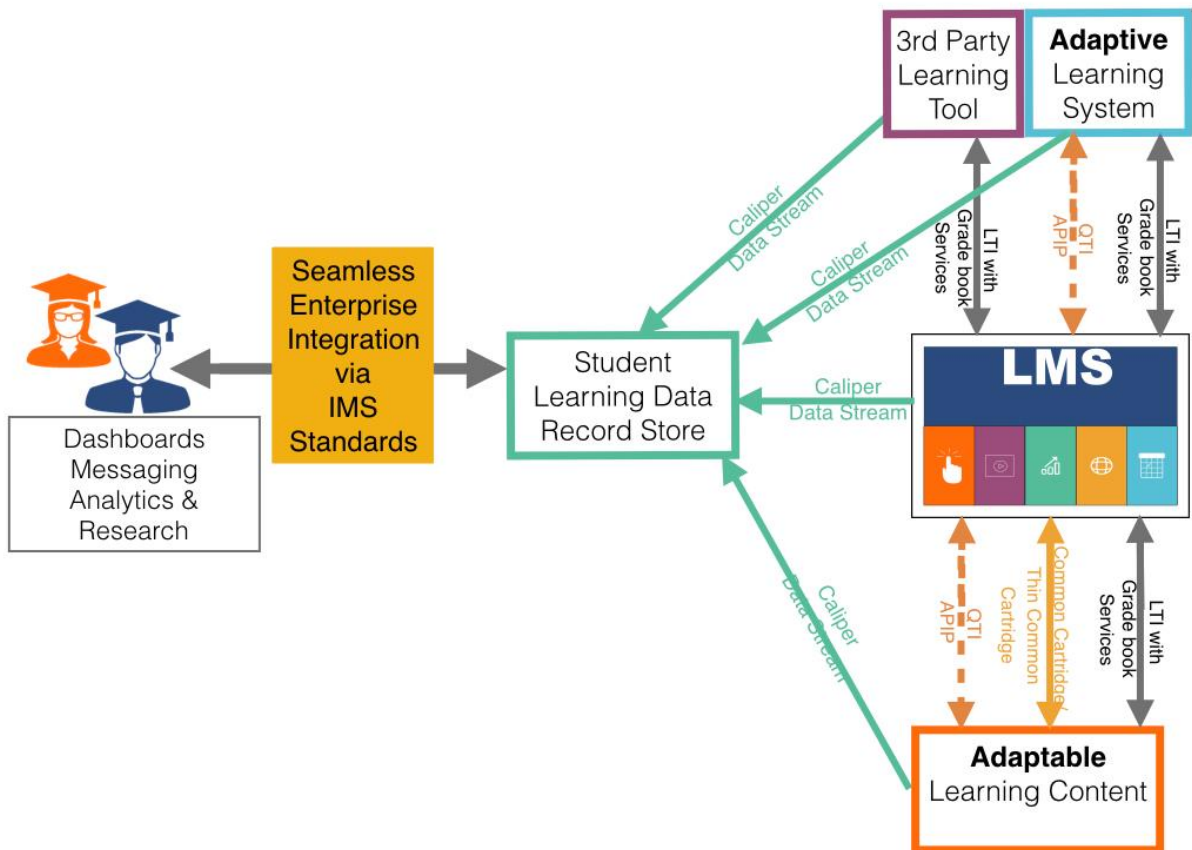
Using AI tools like chatbots or language translations to enhance student engagement by providing quick feedback, interactive sessions, and customized learning materials.

Eight learning technologies that are enabling change
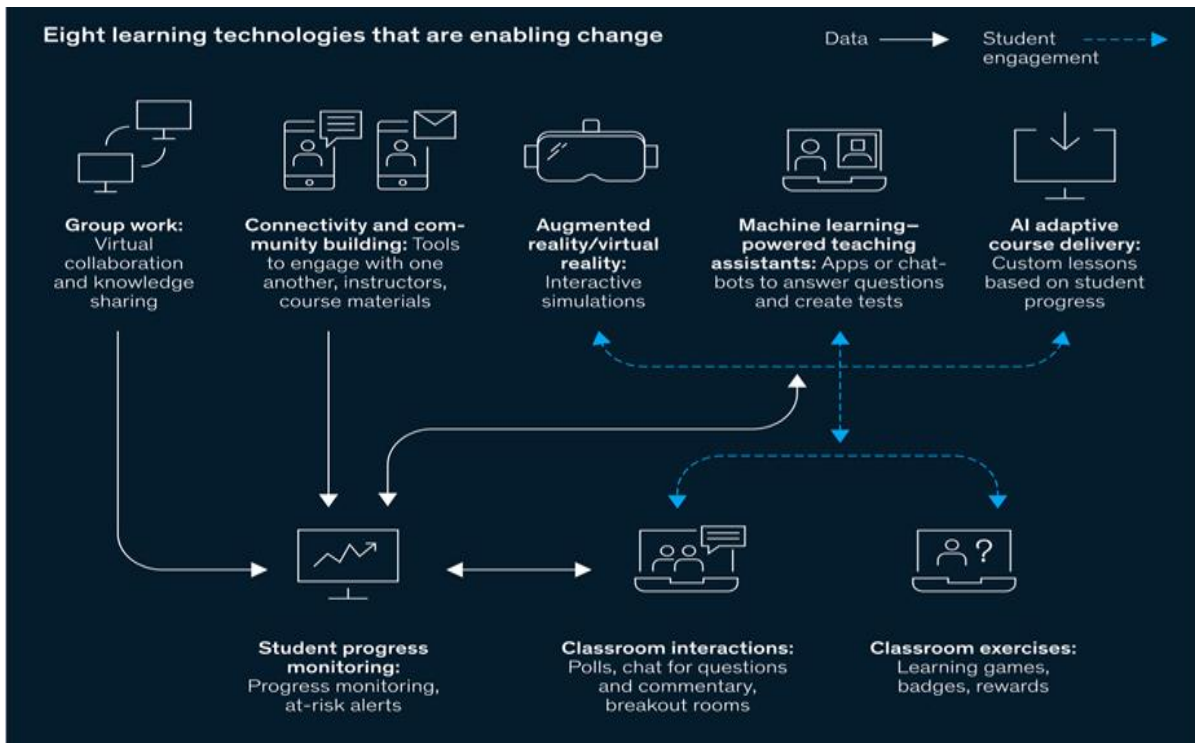
Workplace learning should be matched to the organization's challenges and goals. Through professional consultation, state-of-the-art online training platforms, and long-term devoted support of creative and immersive digital training solutions, Design Digitally will teach, inspire, and excite your organization's staff. This adaptive learning platform creates personalized digital training solutions for your employees that are backed all through the life cycle and tracked using statistical data to help you make more informed future training decisions.

6.3. Mobile learning technologies

Developing learning platforms and content that can be accessed on mobile devices such as smartphones and tablets, allowing students to learn on-the-go.
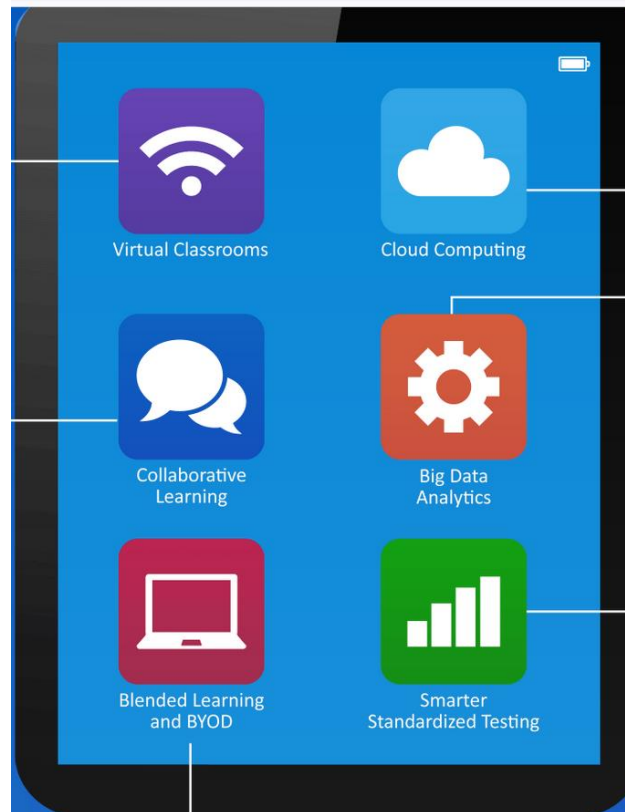
Smart Sparrow

In 2011, a research group in Australia (the Adaptive Learning group) created Smart Sparrow. The adaptive learning platform, situated in San Francisco, specializes in adaptive and engaging learning experiences.

Though many students find online learning appealing because of the versatility and accessibility it affords, Smart Sparrow discovered that the process of online learning often turns students and teachers off. As a result, the platform simulates the in-person experience for students, allowing them to engage in as much hands-on learning as possible.

Half platform, half service, the service provides educators with both the platform and the assistance they need to construct their plans and educate students according to learner feedback. Many adaptive learning technologies rely on algorithms that eliminate specific personalization for instructors, making this a unique differentiator.

Shown below is a floor plan with key elements of the plan numbered.

Identify the key feature represented by each number.
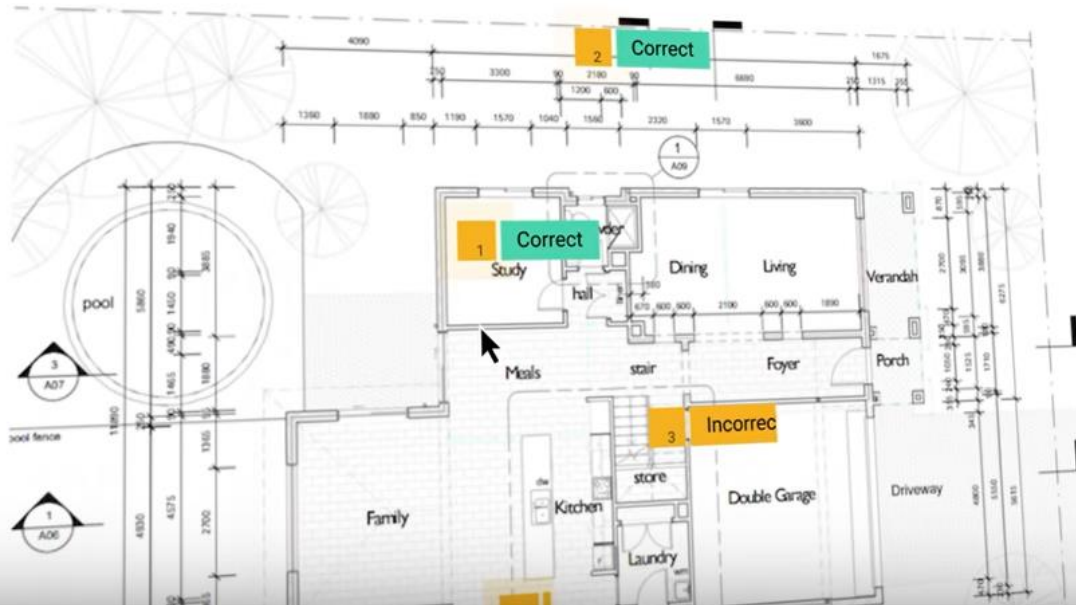
Feedback

Here's a refresher video on floor plan features. Watch the video then have another attempt at the activity.

6.4. Immersive Cave Automatic Virtual Environment (CAVE) System

Using virtual and augmented reality technologies to create immersive learning experiences, simulating real-world scenarios to help students improve their problem-solving and decision-making skills.

**Immersive Cave Automatic Virtual Environment (CAVE) System**

The benefits of this system are as following (https://inno.emsd.gov.hk/en/it-solutions/index_id_108.html):

1. Support MR (mixed reality) interactive training
2. Support multiple users' collaborative task in simulated environment
3. Support full spectrum view of 3D model in immersive environment, such as BIM model
4. Wireless and lightweight 3D glasses
5. Training practice in scenario that cannot be often accessed, such as hospital E&M installations and fire department

As well as, CAVE system will help to the medical fields to understand the nanoparticles of human organisms.
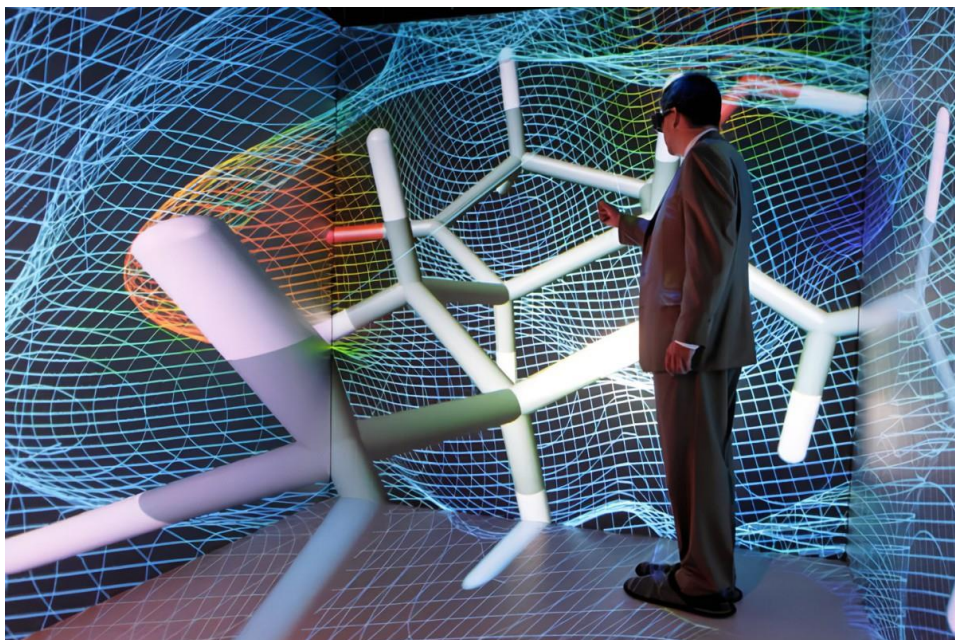
6.5. FLAIM Systems

FLAIM System is a software platform used to build virtual reality firefighting training simulations. It provides realistic firefighting scenarios that can be used to simulate and train emergency response personnel. The system uses various technologies such as artificial intelligence, virtual reality, and haptic feedback to provide realistic training scenarios. FLAIM system is developed by FLAIM System Pty Ltd., Australian company.

From bushfires in remote locations to fires on aircraft, industrial sites and residential properties in urban areas – FLAIM Systems has developed 80 different virtual reality (VR) training scenarios that allow firefighters to train across different situations with no risk to their health or the environment. With more than 10 million professional and volunteer fire fighters around the world, this technology offers the potential to make training safer for firefighters and the environment on a global scale, with the company already working with over 300 emergency services agencies, defense and higher education organizations and private enterprise in 45 countries, with the primary focus on scaling opportunities in Australia, the USA and UK.

Net proceeds of the $6.7 million capital raise will be applied towards development of FLAIM Systems' technology stack, focusing on building an in-house learning development platform, strengthening its team across executive, technical, sales, marketing and customer experience roles, and working capital to support scale-up and fund a shift from capital sales to subscription sales (Flaim, 2023, March 29).

Opportunities:

- As FLAIM training is virtual, there is no carcinogen exposure to the firefighter or instructor, and 2,000 hours of annual training in one system saves the equivalent of 20 million litres of water and 27 tonnes of carbon emissions (Flaim, 2023, March 29).

- Several fire departments in Australia and the US (as well as the UK, Netherlands, and other countries around the world) are using FLAIM to train their firefighters.

- The VR technology immerses firefighters in virtual scenarios that are just too dangerous or difficult to recreate in the real world – including wildfires and areophane fires.

- Amazingly, the VR tech realistically renders all the fire, smoke, water, and fire-extinguishing foam – as well as the heat, thanks to a special heat suit that can heat a

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firefighter up to around 100 degrees Celsius (212 Fahrenheit), depending on their proximity to the virtual fire. The system even replicates the powerful force firefighters feel from the water hose.

CHAPTER VII

Conclusion and implications

Realistic simulations provide realistic simulations of firefighting scenarios, which can be used to train emergency response personnel. As well as, they can also be used to simulate other high-stress, high-risk environments, such as medical emergencies, natural disasters, and terrorism scenarios. This can help improve the effectiveness of training and prepare trainees for a variety of potential situations they may face in their job roles.

Hands-on training systems provide hands-on training, offering a safe and controlled environment to practice and refine firefighting techniques. This technology can also be used to train personnel in other fields, such as transportation, logistics, and heavy machinery operation.

Cost-effective systems for training could reduce costs associated with physical training and equipment. Fire departments, for example, can reduce the number of resources needed to create live training scenarios by utilizing the virtual environment. Additionally, by preventing accidents or workplace incidents, FLAIM can save organizations money in the long run by minimizing costs associated with damage, injuries, and lawsuits.

Personalized training systems can be adjusted to provide personalized training for individuals and teams, based on their current skills and experience levels. This can help optimize training programs and ensure that each person is progressing at their own pace.

The cutting -edge technology-based systems can be accessed remotely, allowing individuals to train from any location with an internet connection. This is especially useful for emergency responders who may be stationed in remote areas.

The newly-designed systems can provide real-time feedback and evaluations, allowing for immediate corrections to be made to techniques and strategies. This can help improve overall performance and ensure that individuals are fully prepared for real-life situations.

The systems can also gather data on performance, which can be used to optimize and improve training programs. It can help identify areas of strengths and weaknesses, and the data can be analyzed to develop new strategies and training techniques.

These systems are scalable, meaning they can be expanded or reduced according to the needs of the organization. This allows for flexibility when training large groups of individuals or when there are changes in the number of trainees.

Overall, our suggested systems can contribute significantly to the effectiveness and efficiency of training programs across various industries. By providing an immersive and realistic training experience, they can help individuals better prepare for their job roles and ensure that they have the knowledge, skills, and abilities to handle any situation they may face.

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