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Chapter 10: Transforming traditional educational delivery methods through the deployment of intelligent cloud systems and data-enhanced instructional tools

10.1 Introduction

Transforming Educational Delivery Methods with Intelligent Cloud Systems - The high development of communication and computing technologies has brought new opportunities for both users and educational institutions. Specifically for the classroom, new technologies tend to increase the cost of hardware resources and software licenses. The cloud computing model allows the offering of these resources at a highly reduced cost. Cloud computing is a highly appealing solution for organizations, since it avoids over-investing in hardware resources, software licenses, and staff. Nevertheless, its applicability often goes against the production of standard services for general use, but also for niche markets like education — knowledge sharing. For flexibility and high tailoring of services and resources to specific educational needs, and considering integrated strategies that involve the development of specific educational delivery, the discussion is illustrated with the Transforming Educational Delivery Methods with Intelligent Cloud Systems. The regulatory framework tailored to education in the cloud is very recent, and educational institutions are asking for wise and prudent analysis of technological progress and migration. Educational content is generally structured for multiple formats, considering different media, different strategies of broadcasting, and different devices; presentations, videos, and interactive material require plans centered around new products and services with contributions to the educational delivery that have economic logic associated with immediate demands in cloud resources.

10.1.1. Overview of Educational Landscape and Evolving Practices

The educational landscape is rapidly transforming: digital empowerment of students and faculty, scalability of educational delivery, and the technology democratization of educational tools have led to a fundamental rethinking of the educational delivery paradigms. This chapter introduces the evolving educational landscape and educates the reader about the process-by-process intelligent cloud solutions that are now enabling this transparency between the multiple roles earlier played by individual faculty members and institutions, and enabling new roles of vertical domain experts who are also joined by horizontal technology partners. In summary, this chapter introduces the reader to the emerging transformation of EduTech and three very interesting success stories of the various stakeholders that can make the real re-imagination of the educational frameworks possible—by both online or blended methods that successfully solve the classroom-to-console transitions.

Fig 10 . 1 : AI in Education

An effective way of learning that advances the capabilities of the students or employees of an organization requires a well-understood need for skill reinforcements, a time- and cost-efficient method to solve the skill gap, an educational delivery method tailored to optimize the learner's outcomes, and an easy continuous cycle of ever-increasing or reinforcing the skills of the subjects. Consistently providing this feedback loop is not trivial and requires not just the right choice of methods, but also the right selection of tools for continuous educational improvement. This shall motivate the choice of cloud infrastructures as the right enablers for the ever-increasing need and expectations of updated educational experiences and provide a snapshot of three detailed cases—from three independent vertical education domains—in healthcare education, teacher education, and the disciplines of hospitality services education.

10.2. Understanding Traditional Educational Delivery Methods

Traditional educational systems have been around since mankind began to strive for more organized approaches to learning and to becoming more intelligent beings. Over the centuries, the traditional teacher-student educational model was transformed first into classrooms with more students to more efficiently utilize the time and resources of individual teachers. Electronic tools such as blackboards and projectors were then introduced to help teachers communicate with and instruct large numbers of students at one time. Distance education through live video feeds was also an important next stage.

Yet, due to growing student populations and increased ambitions to further universalize education, immense demands are now placed on educational systems that are basically one-size-fits-all from both the instructors' and the students' perspectives, even when the subjects being taught are complex. Instructors are expected to increase both curriculum coverage and student learning in a limited amount of time. They are also supposed to craft their approach to accommodate students with different strengths in different areas. To optimize learning efficiency in large classrooms, education is generally prepared and delivered using the least common denominator approach, where more attention is given to what questions need to be answered than to what concepts constitute the actual foundation for learning.

10.2.1. Historical Overview

Historically, education has undergone a series of delivery method transformations. These transformations occur in response to the changing needs and knowledge requirements of industry and society. Throughout history, the various forms of knowledge delivery methods have evolved. Initially, educated persons had relatively little knowledge to process. As historians look back, it is clear that the perceptions of early knowledge specialists, instructors, students, and employers intersected with the objectified values of education, which had by and large resulted from those perceptions. Once societies began to develop, education and its delivery became increasingly institutionalized.

At first, students would travel to an instructor or group of instructors who would give a series of lectures over a period of time. At the conclusion of this process, the instructors would administer a qualifying examination. If the student passed the examination, he was regarded as having completed the course of instruction and was awarded a degree. The degree served as a source of documentation needed to obtain better employment. This system of knowledge delivery was one of the earliest methods for educating a population and remains a widespread practice today. The content-area expertise of philosophers was another ancient method of education. In the Old Testament, the King of Israel instructed the ancient prophet Elisha to see whether it be well with thy brethren, and well with the flocks. In Elisha, we see the beginning of the role of the kings and priests acting as primary education instructors.

10.2.2. Limitations of Traditional Methods

To remain competitive in today's technology-driven world, students, families, government, and corporate officials alike expect that all educational institutions will use the most advanced tools to produce the best possible educational results. Many institutions using traditional teaching methods face increases in tuition, a shortage of good teachers, and more students dropping out of college or university altogether. Students are not able to afford the technology, supplies, tools, equipment, educational resources, and research material, or faculty needed to achieve their full potential and compete with students from higher-resourced institutions. Dropout rates remain a serious problem. A significant proportion of higher education is spent by students teaching themselves from books, other materials, or online sources, rather than being actively engaged in learning through well-designed instruction, mentoring, research, and hands-on experimentation found in a typical non-lecture-based instructional science, technology, engineering, and math laboratory, studio, or project site course.

Research shows that internet-based hybrid course systems in large introductory science and math courses are not a sufficient solution to solve these problems. These hybrid courses are usually delivered in traditional classroom settings by instructors and guest speakers who still rely on verbal and written interactive methods to teach math, engineering, and science concepts in a fairly suboptimal way compared to the abilities of state-of-the-art software tools. These software tools were developed by the academic community, government, and the electronic gaming industry but are not widely used in higher education. Consequently, far too many students fail to learn difficult concepts, are often disappointed, and eventually leave their chosen degree programs at a given institution to look for a better quality educational experience at another educational site when dissatisfied with the continued use of traditional educational delivery methods for an expensive degree.

10.3. The Role of Intelligent Cloud Systems

Web-based intelligent cloud systems offer specific opportunities to improve education delivery over traditional education delivery mechanisms. In this paper, we illustrate the offered promise and an initial implementation of a cloud-based system that focuses on the case of a pre-lab environment for computer science students. The initial systems build on service-based principles, confront many technical and educational issues, and use best-of-breed tools that are in the marketplace. The global IT industry is moving with increasing speed to implement internal employee cloud-based education systems built on intelligent cloud system principles. The expectations for improved operations, responsiveness to customer needs, and overall higher productivity levels are very high. However, many universities, especially in the computer science field, have yet to roll out significant curriculum and pre-curriculum intelligent cloud-based interactive educational tools. The heaviest use of cloud services in education seems to be confined to exchanges of static resources, with universities increasingly making big use of external cloud services for web-based learning management systems, student and faculty email, and calendaring services, and support for the implementation of MOOCs.

Student outcomes from traditional lecture-based computer science labs and from project and team-building software development environments can yield substantial educational benefits for university computer science students. However, delivering these benefits can be challenging as student outcomes can be sensitive to large class size considerations and to staff skill and availability; to the existence of pre-learning experiences and problem-solving aids that can be easily and uniformly accessed; and to the presence of effective pre-learning measurement feedback that directs students to the activities they need to do, only those pre-learning tasks they do not already understand. In this paper, we illustrate the pedagogical principles, educational process designs, and the heuristics used to design the fidelity and provide the quality of the necessary time efficiencies of a web-based pre-desktop software learning process.

10.3.1. Definition and Features

Education is the process of giving intellectual, moral, and social instruction to someone. It is the process that starts from birth and ends when a person’s life comes to an end. Education is a powerful tool to correct the unsustainable development problems continuing to occur in today’s technology and information-based new world and help people to socialize better. Information technologies offer cooperation, flexibility, effective teaching, and learning interaction, and play a significant role in making education possible. E-learning is a kind of innovative education applied with the help of information technologies, especially since the mid-1990s. To achieve success and widespread use, two important criteria are necessary for e-learning environments: the suitability of learning materials and the adaptability of these materials. The solutions mentioned depend on cloud computing for smart systems, and the necessity of the association of accessibility, scalability, interoperability, and utility to fulfill e-learning functionalities is significant.

10.3.2. Benefits for Educational Institutions

The use of IT in education continues to gain popularity in a dynamic environment. Thus, the innovative use of software and technologies can promote excellence in international education by developing key competencies and complex learning outcomes in a diverse environment. Educational institutions typically have access to a wealth of information about educational service consumers, such as teachers, students, and students' parents, as well as about organizational processes and assets. The use of artificial intelligence (AI), combined with the capabilities of large cloud data processing and storage as intelligent cloud systems, allows for more effective use of that information in all areas of educational services. The educational institution's access to modern IT technologies, such as cloud-based services, ensures the improvement of the quality of educational services while maintaining an effective cost balance. A number of private cloud-based systems have been established for educational institutions, for example, cloud-based systems. These cloud systems have data centers in the European Union and provide comprehensive technical solutions that can be connected to an institution's basic and app-specific data sources. Consequently, the educational institution is able to securely migrate both its student information system and other core services, which are built to perform independently within the institution's IT infrastructure, to the cloud, as a way of creating an integrated intelligent cloud solution. Therefore, the educational institution also gains new opportunities to access cloud-based capabilities of various knowledge-intensive services. Through the educational institution's close collaboration with technical support teams and experts, it is possible to gain these benefits and to use cloud systems to ensure information security.

10.3.3. Case Studies of Implementation

Deploying Emerging Technologies in a Nigerian Higher Education Institution: This case describes the deployment and use of the Moodle LMS in a distance education program in a Nigerian higher education institution still using a primarily teaching-centered approach. The major ICT infrastructure challenge facing the institution was unreliable electric power distribution, as over 80% of ICT equipment and services were supported by the use of standby generating sets and an unreliable national grid. The use of cloud computing technology to deliver e-learning in an environment with an unreliable network is not feasible since its use would be impaired even if the institution has always-on internet access and electricity. Therefore, it was impossible to implement a central cloud system that would accelerate data transmission and computations.

Using a mixed-method research, two groups of 100-level students studying distance education were used as survey respondents to explore the impact of the implementation of a focused plug-and-play cloud system using the responsive web design feature as the 'access interface.' The proposed model was able to increase student satisfaction significantly for Computer Science and other students, as most said that the interface was fast and efficient, and that information was being fetched in time and efficiently. Staff also gave credit to the fact that they did not see frozen screens, and that switching users was easy and did not corrupt data, as both staff and students were using the same responsive design-based interface. Results indicated that the implementation of the focused plug-and-play cloud system within a Nigerian higher education distance program without efficient electric power distribution was feasible.

10.4. Data-Enhanced Instructional Tools

The exabyte data era and the cloud systems that store and manipulate this gigantic data will enable educational delivery methods that use the latest online content materials and instructional tools based on insight and experience derived from educational big data. Advanced learning systems are cloud-resident applications that present educational materials and quizzes, evaluate student performance, and guide learning. The event data generated by worksheets and quizzes in these and other cloud-based learning applications can help designers evaluate the effectiveness of the learning materials and instructional tools. Did students who chose a particular path through the material perform as well as students who followed an alternative path? Which quizzes on the material were the best predictors of understanding, and which were flawed because the quizzes were too complex, too simple, or too closely followed the content of the learning materials? When students perform poorly on pre-quiz questions or fail to master the material by the time of exams or standardized tests, how did the teachers respond, and what was the effect of their actions?

Responsive online resources include web-based interactive tutoring systems and those that draw from a student model to provide individualized feedback and support. Educators have also experimented with a mix-and-match use of e-textbooks, lectures, educational games, media resources, guest lecturers, digital libraries, and web-based support materials. The cloud-based delivery methods have the potential to take advantage of educational big data, which becomes available as teachers integrate these resources to support a variety of user-defined pedagogies in a student-centered blended learning environment. The exploratory phase research questions include:

1. Given such educational big data, how can an educator personalize the learning resources to most effectively help students meet these varied educational goals, which may change from student to student and even day to day?

2. How can we organize the learning artifacts of educational big data to enable data mining techniques to discover the educational conditions under which the personalized learning resources are most effective?

10.4.1. Types of Instructional Tools

Instructional tools are an important part of the educational process. They allow the educator to visually structure and emphasize educational material, present various types of information, and further organize important components of the learning process. Instructional tools include blackboards, chalkboards, and more recently electronic presentation media such as projectors and computer-based systems using monitors and overhead transparencies. In addition to these conventional devices, various computer-based tools including virtual blackboards have gained notice. For example, tablet PC applications utilize a smart pen and digitizing pad to capture and transmit images directly to the computer, potentially providing an unobstructed view of both the educator and the students while minimizing the length of time an educator must write with their back to students. Tablet PCs, in particular, have been recognized as very effective instructional tools among educators and researchers because they support lecture recording, real-time voice reinforcement, and the presentation of pre-planned lecture slides on the main screen while viewing previous and future slides.

New tools provide a more interactive and efficient way to obtain knowledge and share thinking than a simple lecture-based approach. These tools are inquiry-oriented instructional formats in which most or all the information through which students work comes from the web. They have defined four purposes: (1) to use a minimal amount of teacher time to help students; (2) increase the use of higher-level thinking and skills such as interpretation, problem-solving, and creativity; (3) direct students to work collaboratively; and (4) make the best use of the internet for learning. In these formats, students are involved in making judgments, solving problems, and developing solutions through information processing. This model largely depends on five key components: (1) Introduction; (2) Task; (3) Process; (4) Resources; and (5) Evaluation. This approach enhances students' abilities to interpret the web, judge the accuracy of information, question what is viewed, and analyze a properly developed product for quality. These characteristics ideally develop positive learning outcomes.

10.4.2. Integration with Cloud Systems

Educators and educational systems are often wary of the introduction of technology as they have often found that it can become an additional burden on them. Consequently, it is essential to provide technological tools to them in a way that is usable to them. Despite the availability of a number of resources, mainstream adoption of advanced cloud-based educational platforms has yet to happen. However, cloud systems are beginning to provide many opportunities for educators to increase their effectiveness. Cloud systems also have the advantage that they significantly decrease the need for technologically advanced facilities at schools, which are often too high in specification for usual lessons, and the running and maintenance costs of such facilities. Using educational resources and tools provided as part of mature cloud ecosystems leads to cost, speed, and mobility benefits. On the educational side, educators see this as simply a change in direction that allows a new way of providing and viewing course content. When aspects such as grading and feedback are easier to accomplish, this can lead to a change in educational goals. In other words, there is no need for an exception to a variation on Parkinson's law stating that we always increase the complexity of an educational goal and never simplify it.

A number of educational systems have been developed for delivery on cloud systems, often with a degree of customization possible, and the delivery of a partially closed offering while still able to utilize the more advanced technical characteristics of a particular cloud vendor. This is a best-fit solution for the life cycle of curriculum development and for average educational quality management. However, many of the existing educational systems are relatively dependent on the cloud vendor and hence are not universal. Furthermore, a number of educational offerings are presented as worldwide platforms from overseas vendors where the vendor is potentially doomed to lock users into specific vendor technology and cloister curriculum content. It is widely established that retaining sovereignty rights to educational resources is an important attribute for most national administrators. To ensure society has a clear understanding of current educational technologies and how they impact curriculum and pedagogical decisions, it is critically important they remain aware of all aspects in an educational setting. Few educational offerings manage to meet these challenges. When they do, it is often at the cost of having to redevelop and maintain unique or customized application programming interfaces, library configurations, and server instances or classes due to different user performance requirements and security reasons. With it requiring deep knowledge from system administrators around the system and its connectivity across different cloud systems due to poor interoperability between cloud offerings, advanced cloud systems often require significant effort in administrative IT and subject design costs to ensure quality educational offerings to connect, adhere to the constraints, and deliver an organic and managed multi-cloud educational solution. The essential challenge of building an effective learning sequence that will make use of multiple cloud systems involves new developments in three areas:

1. Fully integrated eLearning (e.g., use intelligent content to manage and adapt learning objectives)

2. Open educational resources and material

3. Federated commercial cloud systems.

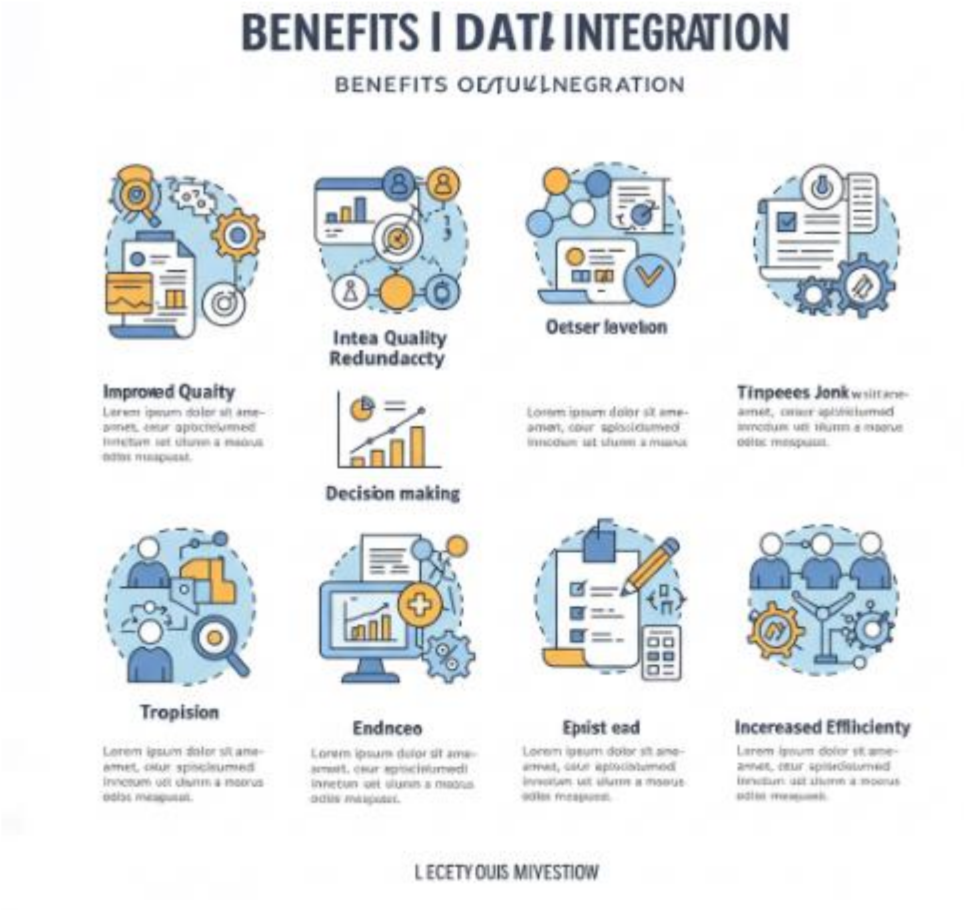

Fig 10 . 2 : Benefits of Data Integration

10.4.3. Impact on Student Engagement

Effects of intelligent cloud systems on student engagement. Throughout time, educational institutions have explored ways to improve student engagement and performance. This is usually enhanced by positive feedback, student-centered learning, activity, and exercise work in addition to projects and home assignments. However, cloud-based mobile learning models can also play an important role in improving student engagement, increasing their autonomy, and facilitating the exchange of ideas with peers and teachers. The principles at work promote varied student participation in formal education and provide many means for enhancing their preparedness and support for autonomous informal learning. The use of mobile computing technologies, like smartphones, tablets, laptops, netbooks, and so on, makes it easier for students to participate and engage in various learning activities. They are becoming increasingly integrated with educational institutions in addition to formal paper-and-pencil assessments to both improve and support the entire learning process. Because students are increasingly bringing smartphones and tablets to school to be part of an incremental electronic information source, they are becoming part of a shared wireless network that schools provide to allow students to access the Internet. Online services have been created. Educational communities and repositories, both local and distributed, use these channels as a means for sharing, collecting, and creating audio, images, and video materials. Important demands have been concentrated on using these tools in educational activities.

10.5. Pedagogical Frameworks for Cloud-Based Learning

As an emerging technology with a potential impact on embraced service areas, including its application in providing intelligent online learning systems, cloud computing applications for education bring along a critical need for transforming educational delivery methods. Successful transformation can be realized through technological innovations in educational platforms and their integration with robust pedagogical frameworks. As a result, educators are now faced with not only the task of choosing an optimal platform architecture for supporting e-learning models but also the need to define the best pedagogical frameworks that govern the design of learning activities and guide the development of a more flexible, adaptive, and intelligent cloud-based architecture.

We make a modest contribution in this paper with a brief discussion on existing learning pedagogies and extend the discussion by identifying domains that have a direct influence on cloud-based learning and influence pedagogical frameworks for cloud-based learning. More importantly, we identify a set of basic elements that form the core of the principal learning pedagogies and discuss their implementation in the context of cloud PLEs. Our principal focus is on the traditional pedagogies that underlie some of the principal learning theories in distance education, highlighting critical considerations that should go into integrating the different principles in evolving cloud-based learning, which may include new technological elements that are not supported by current pedagogical theories.

10.5.1. Constructivist Approaches

Constructivist Principles, Learning Environments and Role of Intelligent Systems Currently, constructivist learning theories have profound impacts on contemporary education research and practice at all levels. Deeply rooted in rhetorical dialogue, this theory was formulated in about 1920. Although constructivist learning theories come in hybrid forms, they have, in essence, several key ideas such as active learning, finding learning situations in real-world tasks, cooperative or collaborative, experience-based learning, goodwill learning, meaningful learning, and socialized learning. Accordingly, teachers assume the role of guides in learning, whereas learners have autonomous learning aspects. Learning is not just about accumulating information provided by someone else, but also encompasses interaction, interpretation, and constructive relations.

Constructivist learning theories emphasize two main sources of learning: physical and social environments. The physical environment presents objects or phenomena themselves, whereas the social environment contains all things or phenomena reflecting on and representing physical objects. As educators began to recognize the value in helping students learn from one another and acquire mutual understanding, the classroom was transformed, moving away from a teacher-centered approach to a student-focused one. Presently, with the widespread use of electronic educational materials, learning can be done without time and space limits. Subsequently, people have acknowledged the importance of creating an interactive and informative learning environment in the face of global competition. In the age of flexible learners and edutainment, people should avoid being addicted to data only. Nonetheless, modern learners should pay more attention to developing a holistic personality, interacting more with their peers, and having multi-dimensional, experience-based, and cooperative learning in their quest to better understand the world.

10.5.2. Blended Learning Models

Blended learning is the combination of traditional, face-to-face classroom methods with online support and learning services. It allows students to learn at their own pace and style, but also promotes better school-to-home communication. In blended learning models, the internet replaces some or most of the "old" tools at the teacher's disposal, simplifying school-to-home communications and often creating more effective tools. The more generic the tools are, the more they can be used at different school levels and types of learning, but these tools can incorporate information and particularities that can be used in specific school systems. This type of blended learning model is an important instrument to improve equity because everybody has access to the same tools to learn anywhere at any time, as long as they are made available.

A center completely equipped for digital education and connectivity can create periodic synchronous moments when the rooms could be used for all students to share the same areas of learning through high-speed internet connectivity and big screens, adjusted to the needs of the students, for tasks conducted with the help of a teacher or tutors hired for troubleshooting, assisting with periodical exams, among other activities. It is extremely important to say that, normally, teachers not only have to prepare each unit but also tutoring activities (including personal information about the student, both academic and more personal data, that should be done so the teacher's memory is not necessary). The rapid development of new technologies and the successful creation of innovative ways for learning concepts might minimize the student's motivation to assimilate the knowledge formal education systems have to propose.

10.6. Challenges of Implementing Intelligent Cloud Systems

With their natural opposition to changes to current practices, many teachers are not open to experiments, although there are significant differences among different personality types, with modern and active personalities scoring highest on openness. For these reasons, the changes proposed must have clear goals and easily demonstrable benefits; in other words, it must be clear from the start that the use of new technologies by both teachers and students is genuinely useful and necessary. Teachers need plenty of support, not only in using the technologies, but also at the psychological level. The level of ICT training in the context of this project appears to be sufficient.

The changes should be introduced gradually and, according to the principle of scaffolding in constructivist education, based on the current state of knowledge, simplifying the process of mastering new technologies. One of the possible risks involved in the use of intelligent cloud systems is the possible decline in face-to-face contact between teachers and students; fortunately, excellent academic support is ensured, further increasing the institution’s added value. Given these challenges and because the educational need for technology and marketing has been demonstrated, the time has come to propose a real solution. To do this, in the next section the most popular cloud systems used for business and household purposes are reviewed, followed by a more detailed analysis of Intelligent Cloud Services, also based on the recent release of an operating system.

10.6.1. Technical Barriers

A multifaceted challenge, technical barriers include a lack of data to conduct scientific studies to understand the learning process, the high cost of technology deployment, systems that are too complex for the average instructor, and the paucity of advanced analytical results that can be easily understood, interpreted, and applied in practice. The learning enterprise is a significant proportion of the GDP of most countries, yet not one conducts large-scale projects to determine root causes of failure in the same manner that they are conducted in high-reliability physical systems of similar size. The paucity of resources resulting in inadequate study is intriguing in light of the costs incurred by systems that graduate students with no skills. Studies may turn out to be revealing anomalies or portents of a deeper malaise affecting the health of the learning system.

Data, with an emphasis on structured data that is easy to access from longitudinal studies, is a particularly challenging barrier. One of the characteristics of a learning system is the large-scale scatter in results that have relatively few outliers and many points straying from a curve relating outcomes to methodologies. One way to collect data about the learning process and to validate it in longitudinal data analysis is to provide students with coaching systems employing a variety of methodologies and collect and analyze the data from these systems. By tracking the performance of students using these study aids and correlating differences in outcome values with differences in methods of learning, correlations can be established. This includes data that cannot be obtained without the use of sensing and other disparate types of health history data to calibrate human learning processes in the same way these help calibrate complex technical systems.

10.6.2. Resistance to Change

Academia is not a neutral place where individuals enroll simply to gain the concepts and tools they need to grapple with the complex world of research, policy, practice, and evaluation (Singireddy et al., 2024; Singireddy, S., 2023). To varying degrees, universities perpetuate and reproduce the culture, values, needs, and self-identity of society. As a result, academics and administrators alike do not easily change their basic beliefs, especially if these beliefs are foundational to their self-identity. Many educators are suspicious of change agents and innovations coming from profit-seeking computer industries that are more interested in quick sales than in long-lasting contributions to greater capital and knowledge investment inefficiencies. Introducing complex, value-added, and highly controversial intelligent decision-making and consulting systems into usually conservative academic organizations is not an easy task. In fact, the task is so difficult that many flawed systems projects have been initiated to automate decision-making and consulting in existing university organizational structures. At the root of the resistance to change in academic organizations is the ingrained belief of many staff members that they are uniquely endowed with the capability to function as consultants and decision-makers. This belief ignores the chaotic, myopic, and non-systematic, often illogical processes that poorly trained part-time students usually follow in making decisions that affect their long-run well-being and the well-being of society.

10.6.3. Data Privacy and Security Concerns

The data residing on cloud infrastructure can be in the hands of unauthorized persons or organizations. Even the person using the cloud services may not know where the data is being stored, especially in the case of multiple copies being maintained at different locations. This could pose legal and privacy concerns since the countries hosting data may have different data privacy laws. Legal disputes may arise in case of any legal issues. We need to understand that just having data in the cloud does not mean that jurisdiction issues related to privacy and data laws just vanish (Koppolu et al., 2023; Paleti et al., 2024; Singireddy, 2022).

At every level, whether in a public cloud or enterprise cloud services, there is a need for physical, customer-level, and application-level security. Authorization to access data, location, and accessibility are important aspects that need to be taken care of. Backup strategies, standards governing integrity, and best practices for privacy-preserving techniques should also be in place. Care has to be taken to not inadvertently develop or use tools and applications that violate data privacy ruling of professional categories like medical practitioners. Industry verticals such as healthcare and insurance, which have personal data of customers, may require more secure systems and could have additional legislative needs. Cloud service providers should be able to enforce laws and data protections when it comes to customer data privacy. In general, all in cloud needs to ensure privacy is equal to, if not more than, conventional systems, and that any lip readings or interpretations are not made.

10.7. Evaluating the Effectiveness of New Methods

An important part of research focuses on the analysis and evaluation of the effectiveness of new methods. Research into the use of effective learning teams and management of individual social interaction through developing an appropriate set of intelligent agents could gain useful understanding from the right interpretation of the method, team performance, and the associated analysis. As learning becomes a social activity in a team environment and virtual classroom, the ability to incorporate timely, effective feedback and coaching into the system is a key feature of a team management approach. The components of the managerial approach are used to form a control and feedback strategy that acts on the performance of the integrated system. Tools are then used to support the manager. Failed or negative experiences and other valuable feedback are often examined only by methods inappropriate for their understanding. Many of the performance management and coaching systems implemented or suggested are found to be naive, and examination often shows a lack of solid theoretical principles behind the suggestions given.

It is useful to examine many instructional parameters while considering the team as a learner. This approach has been used to investigate problems of developing intelligent diagnostic systems for cognitive and motivation issues, particularly for physics learning in a virtual learning environment. A schema-based approach for the development of high-quality, interactive, and adaptive course materials with transparent knowledge and learning rule sets is based on the approach developed in the modeling of physics problems using intelligent systems. We suggest that cybernetic concepts, tools, and models could be used to map strategies for the metacognitive monitoring and control problems introduced as necessary in these areas for an open-loop educational environment. Results from the use of an intelligent tutoring system model, with its purposeful pedagogical tutor and reliable student model, could be interpreted in terms of feedback control open-loop educational system models. Work examining pedagogies for successful, individually referenced, formative assignments or team assessment of learning in virtual classrooms with game-based and mobile educational applications could be used to study open-loop integrated learning team behaviors. Other work on the role of intelligent feedback tools in increasing team learning effectiveness could be used to study closed-loop learning behaviors. Similarly, more research into effective feedback strategies in open-loop and closed-loop team learning environments would be useful.

10.7.1. Metrics for Success

We embarked on an interdisciplinary and cross-institutional collaboration to transform educational delivery methods and redress the growing STEM workforce crisis by offering affordable learning opportunities to a broader pool of enthusiastic candidates. In this paper, we describe our experiences, insights, design principles, the computational architecture that makes it possible, the learning assets we developed, and our next steps. We have generated unique insights into the benefits, efficiencies, and scalability of our unique approach.

We establish a range of measures to understand how our novel methods affect students and instructors. For students, we are interested in the long-term impact of this early exposure on their educational and career choices, their performance in subsequent courses, and their persistence rates in pursuing a STEM degree. Questions that we are addressing include: How many students who thrive in our class are encouraged to seek a concentration in Computer Science, even though they have not pre-selected the area as a preferred major at the time of applying to the university? How many female and underrepresented minority students are influenced in their academic and career choices by this particular experience? How do students perform in the subsequent foundational class compared to other students? Are there any demographic differences that should be addressed in order to level the playing field?

10.7.2. Feedback Mechanisms

A key aspect of effective education is to provide effective feedback. A key concern with the existing university support is that the feedback is untimely and, in a majority of cases, merely provides the final grade with no detail. In the machine learning system, we use a feedback mechanism where the system provides advice to the student. Much of the advice given is, of course, material and process related.

With the system, there is a need for continuous feedback to the student from the computer as to whether the student is passing or not passing the competencies in the database. From a pedagogical perspective, this is necessary for the student to build long-term knowledge. However, it is particularly important in an online assessment environment for the student to gain a better understanding of the self-paced nature of the study and the activities as tasks beyond the classroom lecture environment.

10.8. Future Trends in Educational Delivery

In this article, we have demonstrated the use of intelligent cloud systems in learning success programs. By extending these programs to offer learning tools that can be leveraged by millions of students around the world, we have shown that the benefits of fostering student studies can reach more students than the program's original intent. We have described the architecture of the learning support systems to offer tutoring services for students in the program. We demonstrated the use of linguistic analysis tools. Additionally, we showed how to extend the language models to provide support for domain and course-specific topics. We have described the eTaaS, LaaS, and TaaS systems developed, which are built to offer tutoring support to students while ensuring high standards for security and privacy.

Aided by the evolution of AI models available through intelligent cloud systems, we have been able to provide learning success support tools to millions of students worldwide. Immediate feedback and tutoring tools available through the tutoring system have removed an important student stressor and allowed students to devote their learning resources to the development of their course-specific knowledge domains. This has removed barriers to student learning and has resulted in students' achievements in their courses. Additionally, we believe that this approach offers the opportunity to improve student temporary frustration, which often leads to them dropping out and not successfully achieving the benefits of a college degree.

10.8.1. Artificial Intelligence in Education

As educational systems are undergoing progressive digital transformation at an accelerating pace, with information technology turning into the primary competency and opening brand new views on teaching, the adoption of AI technologies has started to assume special significance due to their reinforcement of the traditionally human-dominant touch in the learning process. An increasing proportion of teaching and administrative staff is considering AI tools as a key ingredient in the groundbreaking changes expected for education. The exhaustive investigations documented in this chapter have introduced a new approach to considering the educational ambience as actively leveraging AI technologies and their associative Intelligent Learning Systems and Intelligent Cloud Systems, responsible for managing teaching activities and the resources used to facilitate student learning.

Solving particularly profound issues that institutions of higher education are experiencing, while courageously embarking upon AI deployment, requires much more than trivial resource providership. These analyses unveil the challenges and demands for AI technologies that higher education administration and teaching staff are actually feeling. The issues are somewhat aggravated by the fact that, nowadays, although rich in experience with digital technologies, education is still a bit reluctant to adopt wider-based AI-powered solutions, including reinforcement by AI of the traditionally human-dominant touch in the learning process. The major contribution to the literature is expanding the traditional discussions on the AI-Plus paradigm, aiming at specific implications for educational organizations. The taxonomies proposed here will be quite useful to initiate an AI-Plus approach in education at a lower level of strategic analysis.

10.8.2. Personalized Learning Experiences

Many schools are striving to become vendors of learning experiences that are 21st century models of ideal learning. To foster such transformative change, there is a growing body of guidance and tools that can help educational leaders answer the following types of questions: How can we best capture the energy, ideas, aspirations, and cultural diversity of our students in ways that facilitate and enable learning? How can we best engage faculty and staff in opportunities to learn and change for the good of themselves and their students? How can we help families know about and engage in the implementation of enriching learning experiences? How can we best engage with our community to extend learning opportunities for our students? Leading these transformative efforts must be guided by the sense that today's communities and tomorrow's societies deserve schools that touch all learners deeply, that guide learners to realize their full potential, and that shape learners who deeply reflect and who act with the capacity to alter social conditions and circumstances in their community and in their lives.

Personalized learning is the future of student-centered learning. Personalized learning takes into consideration the background, past experiences, and interests of the learners. It combines pedagogy, technology, and student-centered learning to make personalized learning experiences a reality. In this chapter, we aim to understand the relationship between personalized learning experiences and a guitar teacher system. We have conducted a study on three groups of students aged above 15 years to evaluate how the guitar teacher system can be used as a tool to self-tutor and to provide personalized learning experiences for them. The guitar teacher system aims to use technology and innovative pedagogy to create new learning experiences in guitar learning. In particular, this chapter discusses the impact of the guitar teacher on personalized learning experiences and evaluates its effectiveness in supporting and providing interactive learning experiences. The results showed that the guitar teacher had a positive impact on the development of guitar learners and is an effective learning tool for novices.

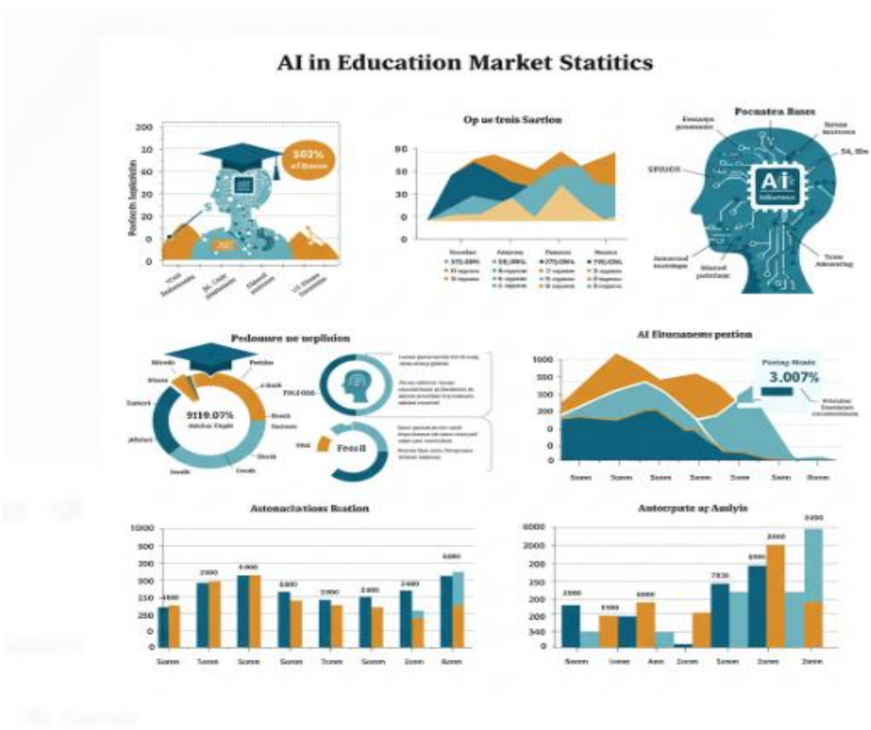

Fig 10 . 3 : AI in Education Market Statistics

10.9. Conclusion

In this paper, we have performed a comprehensive review of how cloud and intelligent cloud systems can change the future of education systems and answered the questions asked in the introduction. These systems are capable of transforming education from being more teacher-centric to more student-centric, interactive paradigms. It is now possible to integrate techniques and methods, which were cumbersome and computationally intensive to be performed onsite, into virtual infrastructure, and realize the true potential of these methods in a global, location-agnostic fashion. This has the potential of realizing the dream of personalized educational delivery models, which can adapt themselves for various learning styles for students and the need to increase their efficiency and satisfaction.

The adoption of these forms and systems can provide invaluable help in handling severe resource limitations associated with school and college education where ready access to easily modifiable software, servers, complex architectures, and infrastructure do not exist. Additionally, it also has the capability of dramatically increasing the accessibility of vast amounts of excellent educational material, research, and discoveries to reach even remote rural areas and schools. Furthermore, it broadens access to the best of the breed, world-leading educators and institutions, and enables their profits without requiring them to commence residence in a location. These systems will have to be leveraged more to keep independent students and their grip on knowledge in terms of complexity and collaboration.

10.9.1. Final Reflections and Future Directions

The developments that are taking place in the 21st century represent a challenge to educational institutions to develop educational programs that enable students, professionals, and managers to work in this new environment. In this sense, it is necessary to prepare education to understand this new electronic culture in relation to society, work, and politics. For this, there is a need to rethink the way of working and the methodologies employed, using new digital tools. Therefore, intelligent cloud systems have emerged as a proposal for a paradigm shift. They offer interoperability mechanisms using open standards in digital repositories to enable services that can be integrated into an institution's educational infrastructure. These systems can automate the previously manual work of administrators, teachers, and students, particularly in distance learning. Thus, they encourage these users to have autonomy in the use of services quickly, easily, and efficiently. Therefore, these systems aim to leverage educational environment data by providing real-time access to shared interdisciplinary knowledge within and between educational institutions. However, it is important to reflect and propose actions aligned with the development of users who increasingly seek content adapted to their needs, daily routines, and learning rhythms. The generation of intelligent services that can help create flexible learning paths—giving conditions so that autonomy becomes the great turning point in a society where digital competency is imperative for insertion into the labor market and critical for exercising the rights of citizenship and full participation in the information society.

This book presents technologies, concepts, practices, and experiments considering intelligent cloud systems applied to education. For this, it analyzes the main points that are directly affecting the involved actors. Additionally, it is also important to consider the results presented. In addition, it discusses the future trends of intelligent cloud systems for each of the technologies presented in the book in order to provoke deep reflections on intelligent cloud systems and education in general. Also, due to the complexity of the topics presented that explore several technologies and reflect on research lines on intelligent systems that can still be studied and deepened!

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