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REVIEW

Emerging Technologies and Curricular Transformation in Ecuadorian Higher Education: Challenges and Opportunities in the Digital Age

Tecnologías emergentes y transformación curricular en la educación superior ecuatoriana: retos y oportunidades en la era digital

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ABSTRACT

Introduction: this essay examines the role of modern information technologies in contributing to curricular transformation in Ecuadorian third- and fourth-level university education, taking into account the experiences of each institution and current public policies.
Method: a search for information was conducted using reliable, prestigious scientific sources indexed by Scopus and approved in Ecuador. This search was structured around conceptualization, institutional cases, challenges, and opportunities.
Results: it is evident that there is a significant benefit from the personalization of content taught in universities, especially in technical programs, because the methodology aided by information technologies (ICTs) significantly improved the development of competencies. However, some educational centers lacked adequate structures and teacher training for the expected correct implementation.
Conclusions: new technologies are new opportunities that allow for strengthening teaching methodological strategies to improve the university curriculum and achieve superior results. Coordinated policies are needed, looking beyond current pedagogy because teachers must have ongoing training and appropriate technological distribution.

Keywords: New Technologies; University Education; Ecuador; Curricular Transformation.

RESUMEN

Introducción: en este ensayo se examinó el rol de las tecnologías de la información modernas que colaboran en el cambio de la transformación curricular en la educación universitaria de tercer o cuarto nivel del Ecuador teniendo en cuenta las experiencias de cada institución y las las políticas públicas actuales.
Método: se realizó una búsqueda de información en fuentes científicas confiables, de prestigio eh indexadas como Scopus y aprobadas dentro del Ecuador, estructurado en conceptualización, casos institucionales, desafíos y oportunidades.
Resultados: se evidencio que existía un beneficio muy grande debido a la personalización de los contenidos que se enseñaban en las Universidades, especialmente en carreras técnicas porque la metodología ayudada por las tecnologías de la información (TICS) mejoraba notablemente la formación de competencias. Sin embargo, algunos centros de educación carecen de estructuras adecuadas y faltaba capacitación docente para una correcta implementación esperada.
Conclusiones: las nuevas tecnologías son nuevas oportunidades que permiten fortalecer las estrategias metodologías docentes para que el currículo universitario sea mejorado y se obtengan resultados superiores. Se necesita políticas articuladas, ver más allá de la pedagogía actual porque los docentes deben tener una

formación continua y una correcta distribución tecnológica.

Palabras clave: Nuevas Tecnologías; Educación Universitaria; Ecuador; Transformación Curricular.

INTRODUCTION

In Ecuador, information technologies are at their peak. Still, the lack of teacher training does not allow them to adapt to the new university curricula to train Indigenous professionals in this era dominated by technology. Augmented reality and artificial intelligence, among others, are tools that have a great scope and prominence in today's education as they are changing how people learn. Third-level educational institutions should use these technologies to train competent professionals in the digital age.

In Ecuador, curricular transformation is regulated by various entities such as SENESCYT and CES, and these entities have to review the new content, methodological strategies, and objectives to achieve modernization of teaching together with ICTs. In this way, they respond to the new demands required by the productive sectors where the new professionals who complete their university studies will work. SENESCYT is the governing body that promotes the improvement of the education system, along with innovation and appropriate technology. Similarly, CES ensures educational quality by regulating, planning, and coordinating the higher education system.[1,2]

Modern information technologies have to be included in the curriculum of the different disciplines taught in classrooms or university contexts. It is not a question of mentioning that they are present with ICTs but of reaching and trying to eliminate the digital divide that exists between the different regions of Ecuador.

Likewise, the lack of teacher training and education in using ICTs is a priority to ensure that the teaching-learning process in training new professionals is of the highest level. Some teachers resist using technology due to a lack of development in using specific technological teaching resources, which significantly limits teaching content to learners.

New technologies can make classes more dynamic and interactive, using varied methodologies that allow for personalized classes and encourage critical and creative thinking in students. In addition, pre-professional practices and organizations such as SENESCYT and CES can collaborate to provide materials for developing and improving the university curriculum and obtaining a proper education that uses emerging technologies for correct learning.

Some guidelines were established from 2021 to 2025 that deal with strengthening and using new technologies to benefit pedagogical innovation in university contexts. On the other hand, the CES, through specific regulations and the academic regime, guides higher education institutions to improve and update educational programs so that they provide quality education according to the needs of students in the digital age.[1]

In short, the curricular transformation that includes new technologies to improve the quality of education in higher education institutions must be regulated and improved by the CES and the SENESCYT. Despite the significant challenges in bridging the digital divide, current technologies must be used to create more capable professionals in the new era. Education with the latest technologies is the future of the 21st century for an innovative, holistic education that meets quality standards.

Conceptual framework

The quality of third-level educational establishments responds to curricular transformations due to the social, economic, and cultural changes in the world and the country in which they are located. In universities, the new methodological strategies taken into account for teaching the content needed by the society in which they are located are verified. Higher education should not be limited to creating students who respond to a single need but requires people capable of transforming, innovating, and adapting to the new challenges of the new era.[3,4]

Therefore, new technologies are digital tools that continue to expand, innovate, and help learners learn different practical or theoretical content. Technologies such as artificial intelligence, virtual reality, cloud-based databases, and augmented reality, among others, help personalize teaching, allowing for more dynamic and meaningful learning.

The Horizon report highlights that higher education uses five main trends for the future of meaningful higher learning: the automation of educational processes, the personalization of learning through data analytics, experiential learning in immersive environments, the integration of global collaborative platforms, and the certification of learning by alternative means such as digital micro-credential.[5]

In Ecuador, higher education is regulated by the CES academic regulations, which have criteria for updating and creating educational programs. These regulations allow the inclusion of optional subjects for curricular redesign and respond to the need for study plans to align with current curricula and links with different

companies. Similarly, they mention that the study plans should respond to the needs of society, taking into account current technology and scientific advances to maintain the educational offer and social relevance.[6,7]

On the other hand, SENESCYT has its institutional strategic plan that is in force in the year 2021-2025 to improve curricular and pedagogical innovation in third-level educational centers, mentioning that new technologies should be used for professional training more oriented to the solution of future problems in real life contexts. Likewise, it mentions that institutional capacities in technology, science, and innovation in the university system have to be strengthened.[1]

It is essential to understand that the union of new technologies with different curricula is related to studying new content and significantly improving education, so there is a student-centered learning model. Autonomous learning is one of the current pillars of critical thinking that promotes improvement and problem-solving in authentic contexts. New technologies must be used, and teaching must be done using different methodologies.

Different pedagogical models can be used in universities, such as the flipped classroom, project-based learning, and other key, together with new technologies, to improve university education.[8]

In this sense, university teachers can no longer give classes just by transmitting content as in traditional education. Still, they must be mediators and guides of knowledge through teaching resources and technology. Teachers must use digital resources in all areas that enhance the education process, such as introducing, developing, and evaluating all classes, regardless of the methodology used. Consequently, it is essential that all teachers have continuous training and updating in all educational processes to use different methodological resources that allow for the inclusion of technology.[9,10]

In conclusion, it is essential to emphasize that curricular transformation cannot be understood as a solitary entity but rather as a holistic whole in which teachers guide learning, including infrastructure, social norms, etc. Policies implemented in university education must be continuously evaluated and innovative to support society's needs and the new professionals emerging from university education centers.

Case studies and experiences in Ecuadorian universities

New technologies have boosted university education because they have begun to revolutionize the transformation of curricula in a significant but uneven way in the different universities in Ecuador. The demands of the world allow public and private universities in Ecuador to carry out new curricular reforms that integrate current technologies and the demands of the labor market. The following are examples of the transformation that is taking place in these universities.

1. Armed Forces University – ESPE: Automation and artificial intelligence

The Espe University developed many projects for educational processes in the engineering degree. The institutional vision it has tries to excel with the help of artificial intelligence (AI) and is a breakthrough in the research and scientific field. Similarly, they have created AI prototypes that collaborate with students to answer all kinds of queries.[11]

2. Universidad Técnica Particular de Loja (UTPL): Augmented reality and immersive learning

UTPL has more economic resources, which has allowed them to develop technological resources in augmented reality (AR) and virtual reality (VR). They have an "immersive virtual classroom" project that allows students to explore virtual environments where they can observe real contexts in degrees such as Architecture and Engineering, among others.[9] The learning they provide to their students is immersive despite being at a distance, it is inclusive so that students learn in a meaningful way.

3. Universidad Central del Ecuador (UCE): Virtualization and equity challenges

The UCE, despite having economic problems due to its large population and few resources, has developed virtualization strategies through an educational platform. Curricular virtualization allows syllabi to include digital reforms and online content.[12,13]

Despite the difficulties, the University is making progress in technological developments.

4. University of Azuay and the STEAM approach

The University of Azuay uses STEAM (Science, Technology, Engineering, Arts and Mathematics) to encourage critical thinking and creativity in students through projects involving 3D printing and educational robotics, among other things. This approach encourages students to develop critical thinking and uses technology to develop projects to solve problems in real-life contexts in Ecuador.[14,15,16]

5. Escuela Politécnica Nacional (EPN): Data analytics in engineering education

The EPN uses a personalized and student-centered evidence-based approach using artificial intelligence to help teachers provide pedagogical support for students. The University uses Big Data and learning analytics to

evaluate students. The data available in learning management allows for necessary adjustments to improve the teaching-learning process and to make better curricular decisions.[10,17,18]

Cross-sectional analysis of experiences

Experience shows that Ecuadorian universities have changed their curricula to adapt to new technologies for the benefit of students. Universities, with their resources, have developed different projects so that students can have new experiences and learn meaningfully. Although some institutions have limited resources, they have resources that help to improve student learning. Similarly, there is evidence that curricular innovation and technology have brought about a pedagogical change.

Higher education institutions improve the quality of education by linking up with technology and using new methodologies that allow for the integration of all fields and autonomous learning. The teacher is only a mediator of learning and makes the students themselves learn in a meaningful way. The graduate profiles must be updated to include digital competencies that make students develop competencies such as collaborative work and ICT. Updating content must go hand in hand with redesigning academic spaces that favor meaningful learning and self-learning.

Similarly, the public policies developed by the CES and the SENESCYT must show great creativity in the long term to meet society's demands. These bodies must regulate and provide the necessary resources for students to develop a fundamental transformation to improve technological, infrastructural, and methodological resources. In addition, higher education institutions must be evaluated and given feedback so that they constantly improve to achieve educational quality.

Challenges and opportunities for curricular transformation through emerging technologies in Ecuadorian universities

The structural, pedagogical and contextual challenges faced by universities must be improved by new public policies and these are linked to new technologies and new developments in curricular transformations according to the Ecuadorian context. Strategic opportunities must be realized based on the needs of each university context in order to achieve innovation and good educational quality. Improving these areas will provide a better route for advancing towards new challenges, an inclusive education and better professionals who are visionary in facing the problems to come.

Main challenges

Ecuadorian universities' most significant challenge is equal access to technology, as public institutions generally lack access to it, and some students do not have the financial resources to pay for technological projects. There is a significant digital divide between public and private universities because the former lack the necessary funding and do not have sufficient connectivity or electronic devices to improve student learning. The curricula notably differ between these two contexts, and the expected results differ.[19,20]

On the other hand, the lack of teacher training among most university professors means that students do not have digital knowledge in the 21st century. Teachers must be trained to develop curricular content innovatively so that students have relevant skills for the new challenges they will face as professionals. There are limited efforts to train teachers. However, these do not support curricular needs. The curricular developments that have been carried out may remain in the background due to the lack of teacher training.[21,22]

Likewise, the rigidity of the curricular frameworks does not prevent critical structural changes from taking place with the introduction of technology. Even though the CES allows universities to create flexible curricula, the reality is that they are not made because administrative barriers resist innovation. The vision of higher education institutions must be linked to current reality and global needs, and political will must move towards quality and warmth in educational models.[23,24]

On the other hand, it is essential that when using new technologies, there is an ethical approach to using each user's data; everyone deserves the necessary privacy. Data protection in handling academic information is relevant, and students or users must give informed consent. The benefits provided by virtual platforms or spaces cannot be established beyond the needs of the learners.[25]

Opportunities for change

In Ecuador, curricular transformation and innovation in the use of new technologies exist despite the different problems of each university. Updated public policies are essential for the development of society. Technology is crucial and is recognized by SENESCYT and CES as a means of solving and improving the processes of teaching and learning development and, with this, the development of the national curriculum.[1,2]

Also, the students of this new generation are digital natives, which makes it easier for them to navigate in digital environments. The new students can use virtual platforms and simulators, among other things related to active and constructivist methodologies. The learning that students obtain through the latest technological

means must be used to the maximum by teachers to guide learning.[26,27,28,29]

Universities should form strategic alliances with technology companies and international organizations to improve the quality of education. The curricular transformation and technological innovation process can accelerate the development of curricular reforms in universities. Institutional practices make students better in their academic performance and then excellent professionals.[30,31,32]

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CONCLUSIONS

The design of higher education curriculum transformation is constantly changing due to new technologies emerging based on the needs and trends of the world. Curriculum change must be urgent to guarantee the training of professionals capable of seeing beyond the use of tools capable of changing the deficiencies of the companies where they work. Teacher training must be continuous and valid to be applied effectively in university contexts, making the teaching-learning process meaningful for students. Technologies such as augmented reality, artificial intelligence, and data from virtual platforms are innovations that enable the improvement of content and curricular reforms. The digital divide is a problem, but little by little; it is being inserted in the new reforms carried out by universities that go hand in hand with regulatory bodies such as SENESCYT and CES. The cases presented reveal that the curricular transformation incorporating emerging technologies depends not only on third-level study centers but also on adequate infrastructure, institutional vision, and new pedagogical mechanisms focused on active methodologies. The objective of universities must be to develop new technologies to help solve the shortcomings of old methods and resources. It is not just a question of using new tools but of training professionals capable of solving problems in their daily lives. In conclusion, public policies, regulatory bodies, and institutional vision will make future professionals innovative and enable them to meet global requirements.

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