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# Internationalization of the Curriculum with a Connectivism Approach

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## Abstract

We propose a criterion to plan and manage, in an integral and practical way, the structures and processes necessary for the internationalization of the curriculum at the institutional level, an engineering faculty, and the classroom. This proposal is based on the theory of complexity and connectivism, with the purpose of training future global engineers and other disciplines.

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*Keywords:* Internationalization; curricula; connectivism; global professionals; dimensions

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## 1. Introduction

The “internationalization of the curriculum (IdC) with a connectivism approach”, proposed by Aponte and Peña [1], is a new paradigm to manage the internationalization process at the institutional level, of academic programs and learning environments, from internal nodes to outside networks where communities, knowledge, experiences, subjects and learning can connect globally. In connectivism or learning theory for the digital age, learning is mainly a process of networking and knowledge flux through these networks. The proposed work promotes the education of competent students in the construction of their personal learning networks in such a way that it prepares them to cultivate throughout their lives and to behave like global professionals.

Aponte and Peña [1], formulate a criterion, adapted by the authors Aponte and Jordan [2], which when diagnosed with an instrument based on a rating scale allows establishing the degree of internationalization and the pattern of behavior at the institutional, Engineering curricula, and learning environments. The proposed criteria are related to structures and processes intentionally designed and managed to promote: nodes of inter-institutional relations;

international reference strategies; management of international communities of practice; offer of global teaching-learning scenarios; application of disruptive pedagogies; training for inter-culturalism and global citizenship; constitution of personal learning networks; development of projects with commitment to the United Nations Sustainable Development Goals (SDGs); management of the global profile of students at graduation; development of a culture for internationalization and diversity; management of learning outcomes with international standards. The gaps in the formation of global professionals will continue to widen if the internationalization processes are being isolated activities and not as a part of an international network, what is solved with the internationalization of the curriculum (IdC) with a connectivism approach [3].

The IdC with a connectivism approach considers the University as a system, within which the objectives, strategies and methods must be redefined to create communicational and learning networks between it and the global society, all connections through a diversity of nodes. The curriculum is constructed by transiting in multiple ways to access knowledge, these being analog and digital; active, collaborative and interactive; online; creating local and global connections for the generation of experiential learning [4].

The connective IdC process within an engineering school/college begins with the creation of personal learning networks in which faculty and students access knowledge in different languages and presentation formats, where the challenge is to organize and configure the information with a sense of coherence to develop new ideas that will be confronted with the ideas of others through connections with the various networks in which institutional actors participate. All of the above with the purpose of training global engineers. A global engineer is a professional who has a balanced profile with a deep knowledge in the basic sciences, can integrate multiple disciplines in his / her work and in R&D, has developed intercultural competences, and can apply his / her knowledge in problems that affect humanity”[3].

## 2. Criteria

This new paradigm of internationalization of the curriculum with a connective approach, proposes 50 criteria, which when diagnosed allows establishing the degree of internationalization and the pattern of behavior for the institution, for one or several academic programs or careers and, for one or several environments of learning. The criteria defined are for structure (the basis on which the IdC is built), and for processes (dynamism that gives life to relationships and interconnections).

### 1.1. The internationalization of the curriculum: institutional dimension

In the institutional dimension we have proposed 24 criteria with their descriptors, which are listed below, for dimensions of structure (1-15) and dimensions of processes (16-24) dimensions:

1. *Culture*. The university defines and lives values that promote respect for the different forms of human expression and the understanding of an international and intercultural culture.
2. *Institutional normative*. In institutional documents, internationalization is recognized as a constitutive dimension of the nature of the university.
3. *Educational model*. The educational model includes internationalization as a dimension for the training of students with global competencies.
4. *Strategic plan*. The strategic plan of the university includes internationalization as a priority issue for the development of the institution and for relevant and cutting-edge training for its students.
5. *Internationalization policy*. The university has an internationalization policy, which exceeds mobility and agreements, and defines curricular issues.
6. *Curriculum policy*. Curriculum policies establish the purposes of training global student with global competencies and also a global profile with competencies for faculty for an international curriculum.

7. *Teaching regulation.* The regulation defines faculty development based on an international component: personal profile, training and international mobility, incentives for good practices in internationalization, evaluation of its commitment to internationalization.
8. *Student regulation.* The regulation defines a student profile with competencies for the development of its global profile and establishes some guidelines for international mobility.
9. *Foreign language policy.* The institution has a promotion policy for the development of competences in different languages, it gives relevance to indigenous languages and interculturality, associates languages with cultures and their importance for networking at the global level.
10. *Virtuality policy.* The institution has a policy for incorporating technologies into learning processes and is based on International Society for Technology in Education standards [5].
11. *Mobility policy.* The institution establishes a face-to-face and virtual mobility policy for the construction of learning networks.
12. *Internationalization networks policy.* The institution has a policy for internationalization networks, it fosters collaborative work in networks, determines criteria for the creation of the key “nodes” to build an institutional network.
13. *Faculty management.* The institution has faculty evaluation policies with international criteria: information on the global profile of teachers, global portfolio, international visibility of faculty, work agendas with an international component, monitoring and evaluation of their international participation.
14. *Knowledge management policy.* The institution has a policy for knowledge management with criteria on the protection of knowledge coherent to international parameters.
15. *Accreditation guidelines.* The university evaluates its institutional quality and of its programs, with international accreditation models and standards and includes criteria and mechanisms to identify its reputation and its international ranking.
16. *Benchmarking.* The institution establishes criteria and mechanisms to study and observe good university practices internationally and monitors institutions of higher education in the world that considers as peers.
17. *Management system.* The institution functions as a complex, flexible, open ecosystem, with teams of people that think in an associative way, who know the rationales of other cultures, adapt to changes and function in uncertainty for their survival.
18. *Structure.* Internationalization in the institution functions as a subsystem of connections (between actors, disciplines, nodes, learning and practice networks) and in different dimensions (institutional / colleges / learning programs environments; internal and external).
19. *Information and communication.* The information and communication systems in the institution include the internationalization component and behave as an interconnected system internally and with the global community.
20. *Products and outcomes.* The university registers products and results of the IdC (methodologies, strategies, information, ways of generating and producing knowledge, experiences).
21. *Interinstitutional nodes (associative life).* The Institution builds its intra, inter-institutional and international relations with the intention of building networks: between communities and organizations / embassies / multilateral organizations / universities in other countries / internationalization networks of higher education / chambers of commerce / disciplines, colleagues, websites, books, blogs, databases, social networks, sources of information, concepts or definitions, theoretical positions, schools of thought, cultures, concepts and hypertexts on the web.
22. *Leadership.* The vision of the rector/president drives the processes of internationalization and the internationalization of the curriculum and promotes and establishes autonomous teams with competencies for collaborative work, self-regulation, co-responsibility and acceptance of diversity.
23. *Spaces and services.* The university has interactive classrooms. Students from other cultures, with diverse abilities, or foreigners are welcomed on campus and have services for their integration; The library offers international databases and literature in various languages.
24. *Articulation with the environment.* The university carries out periodic activities with international institutions; its authorities manage joint international projects; officials respond to invitations to present papers at international conferences or seminars; teachers participate in mobility with other foreign institutions.

## 2.2. The internationalization of the curriculum: dimension of the academic program

The 14 criteria proposed for an internationalization of the curriculum of an engineering program or college, contains among others the regulatory framework, the international communities of practice, the offer of global teaching-learning scenarios, the multi, inter and curricular transdisciplinarity, Internationalization activities at home. Each of these criteria of structure (25-28) and processes (29-38) are broken down into descriptors, which are listed below:

25. *Engineering program.* The Engineering program includes internationalization as a commitment to global challenges, the mission and vision have an approach to facilitate the IdC and the international paradigms of the discipline have been reviewed including non-Western ones.
26. *Global profile.* The Engineering program defines a global professional profile thinking about the training that the future demands. For global engineers it is desirable that the rigorous, creative and innovative training be continued from the disciplines that underlie engineering, further progress is made in articulation with other disciplines, the creativity / innovation / entrepreneurship chain is promoted, and a balance is maintained. with the development of soft skills, especially those related to communication, intercultural sensitivity, leadership, commitment and social responsibility and ethical performance. It also requires a more active participation of engineers in the political life of countries to participate in economic and social transformation [2].
27. *Strategic plan.* The strategic plan of the Engineering program or College includes internationalization as a priority issue for the development of the institution and for relevant and cutting-edge training for its students
28. *Study plans.* For the design of the curriculum, individuals from academia and professionals with engineering international experience were involved. The plan allows flexible and individual learning paths for the student. The curriculum organizes knowledge to facilitate the integration of various disciplines. The total duration of the program is in harmony with the number of hours or credits required by international engineering associations. The curriculum is designed by competencies in accordance with the recommendations and studies of international organizations and accrediting engineering organizations such as: International Federation of Engineering Education Societies IFFES/ Global Engineering Deans Council GDC/ ABET/ Asociación Iberoamericana de Instituciones de Enseñanza de la Ingeniería- ASIBEI/ National Academy of Engineering (USA)/ American Society for Engineering Education ASEE / Institute of Electrical and Electronics Engineers IEEE/ International Society for Engineering Pedagogy IGIP/ European Society for Engineering Education SEFI/ The Latin American and Caribbean Consortium of Engineering Institutions, LACCEI, African Engineering Education Association AEEA/ International Council on Systems Engineering INCOSE.
29. *Faculty plan.* The annual Faculty Plan or academic agenda includes internationalization as a priority issue for the training of its students, for research-theory-practice integration, for the construction of personal learning networks and for participation in communities of practice.
30. *Learning communities.* The professors of the engineering programs actively belong to international learning communities; faculty share the results and products of IdC in international academic events; faculty are regularly invited to be professors in institutions of higher education abroad.
31. *Learning scenarios.* The engineering programs creates student-centered teaching scenarios to favor: i) connective learning, ii) intercultural competencies, iii) international mobility, iv) the coordination of undergraduate final projects with university professors abroad.
32. *Educational Technologies.* The engineering program has technologies, internet access with high bandwidth, computers, tablets, learning platforms, which favor communication and connection between nodes of the learning networks of administrators, faculty, staff, researchers and students.
33. *Relationship with alumni.* The engineering programs registers and maintains permanent contact with alumni within the country and who are abroad, involves them in their learning networks and communities of practice, offers them permanent training for the development of their global profile.
34. *Nodes and networks.* The engineering program is a specialized node with international recognition that keeps its connections active with other similar programs in universities or institutions abroad with which

the institution has agreements. The program executes training and research projects jointly with international institutions.

35. *Communities of practice.* The engineering program energizes internal, national and international learning networks, as well as specialized communities of practice.
36. *Research.* The engineering program manages in an orderly manner the discoveries of its discipline to facilitate its use, protection, valuation, distribution and collaboration worldwide.
37. *Multidisciplinary.* Some courses / subject / projects / learning spaces or experiences are taught by professors from universities or international organizations; students participate in research projects carried out with universities and engineering professors abroad; the program performs international face-to-face or virtual events; project learning and integrated projects with other engineering faculties abroad are encouraged; the program plans and manages its specialized learning networks in the discipline; the program incorporates knowledge, ways of learning, teaching and the conception of knowledge from ancestral and non-western knowledge and experiences.
38. *Indoor activities.* The engineering program offers cultural activities that promote interculturality and the global vision of the world; performs extramural and city activities for contact with other contexts and cultures; invites international students and professors of the program and other programs to share learning; encourages the practice of emerging sports worldwide.

### *2.3. The internationalization of the curriculum: dimension of the learning environment*

The criteria for internationalization of learning environments are related to the ability of engineering professors to bring to the classroom practices that promote the training of their students as global engineers through content, active pedagogies, learning networks, the development of projects aligned with the Sustainable Development Goals (SDGs) of the United Nations, the management and evaluation of learning outcomes with international standards.

39. *Formative purposes.* The project / course / space or learning experience includes the dimensions of a global professional (cosmopolitan citizenship, global vision, intercultural sensitivity, performance in various contexts, [6]) The content contributes to the development of some dimension or competence of the global professional proposed by some international association of the discipline.
40. *Innovative pedagogies.* The learning experience has been designed through innovative pedagogical models in which the student is an active subject in their learning and builds their networks with the facilitation of the faculty; learning activities are carried out collaboratively using technologies that are flexible environments and which promote creativity.
41. *Sustainable Development Goals.* The course or learning experience is articulated with the understanding of some of the Sustainable Development Goals (SDGs); the subject / project / course / space or learning experience fosters the skills to educate about the SDGs -systemic thinking competence, anticipation competence; normative competence, strategic competence, collaboration competence, critical thinking competence, self-awareness competence, integrated problem solving competence [7].
42. *Intercultural sensitivity.* The course promotes cultural sensitivity -addressing the cultural identity of other individuals and ethnic and religious groups, mastery of knowledge, attitudes and cultural competencies necessary to participate fully and actively in society, mastery of knowledge, attitudes and cultural competencies for respect, understanding and solidarity with other individuals, other ethnic, social, cultural and religious groups [8].
43. *Global citizenship.* The content or learning experience fosters competencies for global citizenship: understanding of multiple levels of identity, and the possibility of a collective identity that transcends cultural, religious, ethnic or other differences; knowledge of global problems and universal values such as justice, equality, dignity and respect; critical, creative and systematic thinking, including the adoption of a multi-perspective approach, which recognizes the different dimensions, perspectives and angles of problems; development of social skills such as empathy and conflict resolution, communication skills and skills for networking and interaction with people with different stories, backgrounds, cultures and perspectives; collaborative and responsible action to find global solutions to global problems, and strive for collective good, by United Nations Educational, Scientific and Cultural Organization [9].

44. *Contents.* The content or learning experience fosters non-Western knowledge, knowledge of other cultures, the practice of discipline in other contexts and interculturality in professional practice, the use of bibliography in other languages [10].
45. *Personal learning networks.* Students build their own interactive, diverse, autonomous and open learning networks; the student learns collaboratively with a commitment to mutual learning, acceptance of the diversity of personalities / postures / ways of seeing life, of shared responsibility; the student does not depend on limits set by fixed agendas or calendars or by physical space.
46. *Student teacher relations.* The joint construction of knowledge and the relationship of faculty and students focuses on the latter's learning. The faculty as facilitator and guide adopts new roles, teaching methods; encourages students to explore how knowledge is a cultural construction and that changes according to other cultures; The faculty encourages global literacy or the interrelation of concepts and phenomena worldwide. The student is autonomous and responsible for their learning process, acts to respond to their personal needs, sets the pace of their own learning, organizes their time by dedicating a part of it to their training.
47. *Learning outcomes.* Learning outcomes prepare the student for situations encountered in other settings, to understand the connections between the local and the global, the “world-mindedness”, respect and understanding of diverse cultures, the critical evaluation of their own assumptions regarding other cultures and ways of life, awareness about the state of the planet and global dynamics. The internationalized learning outcomes are the knowledge, skills and values with international and global relevance, acquired by the students as a result of the educational experience when studying a course or project for their training as a global professional [1].
48. *Bibliography.* Bibliography is used to supports the teaching-learning process in other languages, includes non-Western paradigms of the discipline, is updated with the latest knowledge trends.
49. *Classroom practices.* The faculty lectures in another language; contextualize knowledge; proposes the realization or use of comparative, interdisciplinary, international studies; encourages collaborative learning; promotes the ability to navigate, critically use information and build connective learning with networks of students from other universities abroad; use simulations or role play of applying their knowledge in diverse cultures; applies pedagogical strategies to integrate heterogeneous groups of students taking into account intercultural aspects, age, place of origin, learning styles; promotes the development of classroom projects with professors from foreign universities; promotes the bonding of foreign students.
50. *Evaluation.* The faculty applies diverse methods for the evaluation of students before, during and at the end of the learning process respecting individual differences and attending to the individual educational needs of any nature (portfolios, works, exhibitions, interviews, simulations, dramatizations, case reports, projects, problem situation, demonstrations); It uses simultaneous evaluation procedures (self-assessment, student assessment, assessment of other teachers to the student).

### 3. Behavior Pattern

The methodology that is proposed once the criteria have been listed, is to prepare a diagnosis of the level of development of each of them, using a Likert value scale as shown in the following example, for the institutional structure dimension:

CRITERIA DEVELOPMENT LEVEL	5	4	3	2	1
1. Culture					X
2. Normative	X				
3. Educational model		X			
4. Strategic plan				X	

5. Internationalization policy		X			
6. Curriculum policy			X		
7. Teaching regulations				X	
8. Student regulations			X		
9. Foreign language policy	X				
10. Virtuality policy		X			
11. Mobility Policy			X		
12. Internationalization networks policy					X
13. Teacher management			X		
14. Knowledge management policy				X	
15. Accreditation guidelines	X				

Table 1- Rating Scale for the diagnosis of the state of internationalization of the curriculum

The rating scale consists of a series of categories before each of which the observer must issue a judgment, indicating the degree to which the criterion is met, based on evidence collected. A simple scale is the following, in which ranges can be generated: i) 5 the criterion is fully met, ii) 4 the criterion has a satisfactory performance, iii) 3 the criterion is met fairly, iv) the criterion is met poorly, v) the criterion is not met.

Each criterion must be assessed with this or another scale, and once the identification of the level of development suggested by the institution, program and/or learning environment, the information is taken to a graph. In these graphs it is possible to visualize if a criterion is developed when it moves away from the center of the graph and needs a boost when the criterion is very close to the nucleus, as shown in the following graphs, called cartographies, which can be designed in different ways:

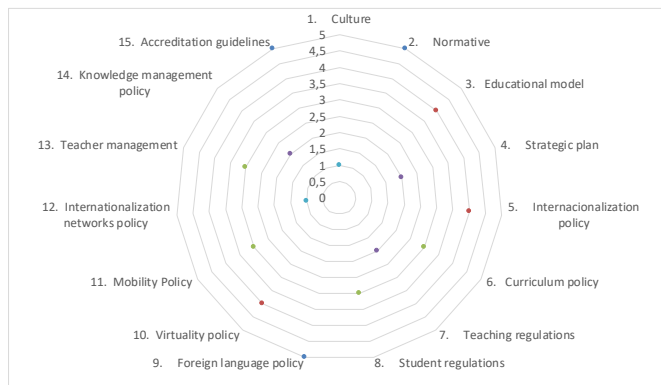


Figure 1- Cartography of the structure of the internationalization of the curriculum: institutional dimension

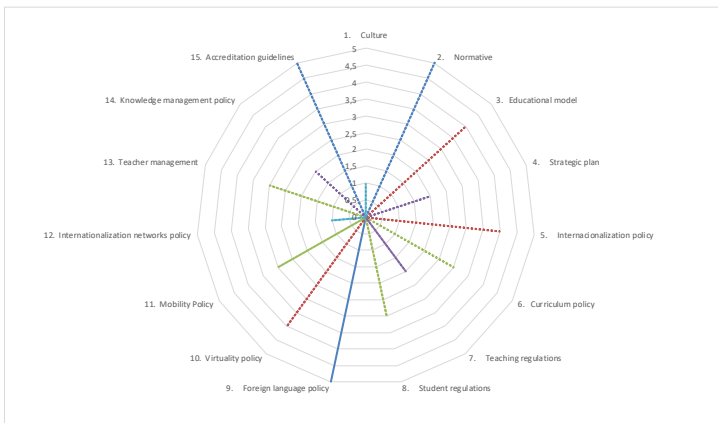


Figure 2- Cartography of the structure of the internationalization of the curriculum: institutional dimension

For the diagnosis of academic programs, it is convenient to compare the cartographies of several of them, and even of the School or College, as shown in the following pattern chart of 4 programs or careers:

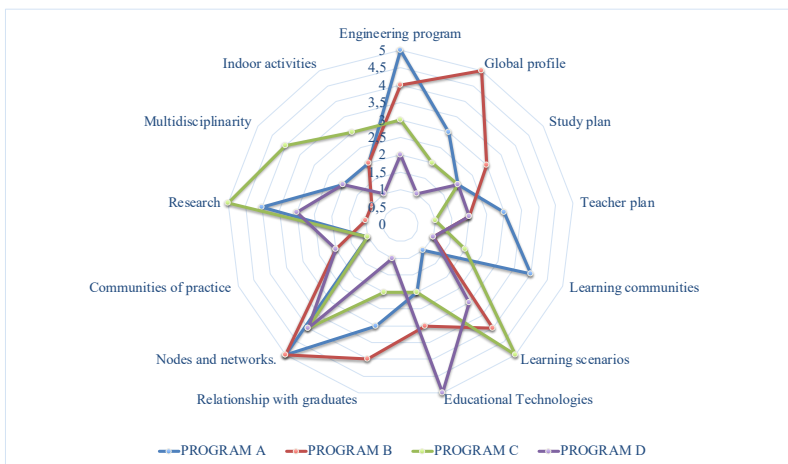


Figure 3- Cartography of the structure and process of several programs

Having the qualifications of each criterion, the same methodology is applied as at the level of learning environments where faculty and students interact. It is also possible for diagnostic purposes to compare the behaviors of various learning environments, to identify which faculty is being more international, and derive a pattern.

**4. Reflections**

The current digital and interconnected world requires addressing the training of students from a global perspective, aspiring to train them as global professionals, with skills for lifelong learning and for their global employability. All must be recognized that learning today is acquired by doing connections and transiting through international networks of learning, research and practice, to interact, associate and collaborate in the possibility of generating new content, knowledge and innovation.



For this, the University must establish criteria to achieve an internationalization of the curriculum, in its organization, faculty / program and learning environments as a complex system. All these dimensions. These criteria must be diagnosed, planned, managed and evaluated, taking into account the reality and context in which the University is located.

The diagnosis allows us to establish a pattern of behavior, which will give light to define an internationalization plan for the curriculum, a faculty training plan and incentive mechanisms. All this with the ultimate purpose of training students with a global profile.

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