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**SURVEYING AND GEOMATICS:
A COMPARATIVE STUDY OF THE ACADEMIC
PROGRAMS OF ENGINEERING AND TECHNOLOGY**

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1. Introduction

- Based on the European experience, in Latin America has emerged The Tuning Latin American Project, which seeks to 'fine tune' the educational structures that exist in Latin America, initiating a debate whose aim is to identify and improve co-operation between higher education institutions, so as to develop excellence, effectiveness, and transparency.

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- Nowadays, the “Universidad Distrital” is in a period of academic renewal, called curricula modernization.
- Curricula review and analysis of social needs are key processes for curricula change in the university.

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■To advance the convergence of curricula in the field of Surveying and Geomatic, a research was developed to know the actual curricula of the institutions of higher education that offer these programs in Colombia, considering their history, semesters of study, number of credits and competences required for graduation.

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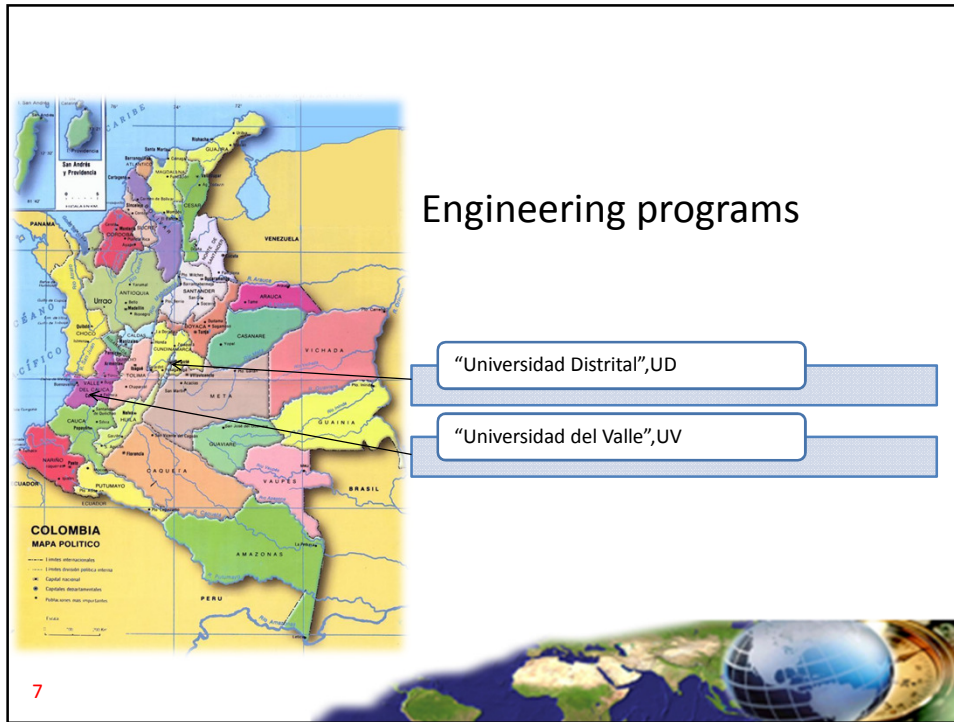


Technological programs

- “Universidades Tecnológicas del Santander”, UTS
- “Universidad Distrital”, UD
- “Universidad de Cundinamarca”, UC
- “Universidad del Quindío”, UQ
- “Universidad del Tolima”, UT

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2. Education in Colombia

- According to the Colombian Association of Universities ([ASCUN](#)) to advance to a higher education system, one requires an open and flexible education to provide high scientific and technological development to the Colombian society, so that the country can be inserted in a global world and compete in it, besides providing solutions to social needs with financial viability.

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- The “Universidad Distrital” shares ASCUN’s proposal and brings two new elements to advance in a quality higher education:
 - 1.To provide graduates with an adequate insertion in the productive world, and,
 - 2.To train people in integrity and civic awareness, who are concerned with the problems of the community.

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The Technological Education in Colombia

- As Victor Gómez (2002) states, *"Since its origins, a major problem with these modes (technical and technological) lies in the low social status, granted to them by a society that favors traditional universities, intellectual work and the ideal of becoming a doctor or professional; undervaluing, therefore, technical and technological education"*.

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3. Methodology

- This project was a qualitative research, following the Tuning methodology, made in two phases, each one with a specific purpose.
- In the first phase the curricula structure was studied using a template for the curricula analysis in surveying.

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- The second phase's purpose was to establish the current state of Surveying and Geomatic in Colombia through a comparison of different curricula in engineering and technology programs.

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- For each academic program, aspects such as history, structure of cycles, length of studies, credits and competences required for graduation, were examined.
- To analyze the curricula, a classification that groups the subjects into four categories was adopted:
 - Basic Science
 - Common Subjects to Technology and / or Engineering
 - Specific Professional Subjects
 - Cross-sectional Subjects

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4. Research Results



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Main Aspects of Surveying Technology

Program	History		Structure of cycles		Lenght of study	Credit	
	Born	Mechanism of admission	Cycles	3.years + 2.years			
Surveying Technology "U.D"	1948	State examination	No	No	6 semesters	Yes	104
Surveying Technology "U.Q"	1964	State examination	No	No	6 semesters	Yes	93
Surveying Technology "U.T"	1961	State examination	No	No	6 semesters	Yes	108
Surveying Technology "U.T.S"	1964	State examination	Yes	No	6 semesters	Yes	99
Geomatic Technology "U.C"	1969	State examination	No	No	7 semesters	yes	107

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From the analysis of documentary information and the interviews with program managers, one can say that the technology programs are in the process of adopting the competences system.

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Main Aspects of Surveying Engineering

Program	History		Structure of cycles		Lengt	Credit	
	Born	Mechanism of admission	Cycles	3 years+ 2years			
Surveying Engineering U.D	1998	State examination	No	A system of approvals is being established.	10 semesters	Yes	161
Surveying Engineering U.V	1998	State examination	No	No	10 semesters	Yes	162
Mapping Engineering U.D	1964	State examination	No	No	10 semesters	Yes	160

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Similar to what happens in the Technology Programs, the Engineering Programs are in the process of adopting the competences system and a state test (ICFES test) is used as a criteria for admission.

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Classification based on groups of subjects for each Surveying Technology Program

Program	Basic Science Subjects			Common Subjects for technology			Specific Profesional Subjects			Cross-sectional Subjects			Total		
	Subjects	Credits	% Credits	Subjects	Credits	% Credits	Subjects	Credits	% Credits	Subjects	Credits	% Credits	Subjects	Credits	% Credits
Surveying Technology "U.D"	4	13	12.87	6	12	11.54	18	51	49.04	12	28	26.92	40	104	100
Surveying Technology "U.Q"	6	17	18.28	4	11	11.83	22	45	48.39	11	20	21.51	43	93	100
Surveying Technology "U.T"	5	18	16.67	3	7	6.48	17	62	57.41	9	21	19.44	34	108	100
Surveying Technology "U.T.S"	6	19	19.19	5	12	12.12	22	59	59.6	5	9	9.09	38	99	100
Geomatic Technology "U.C"	7	18	16.82	5	12	11.21	20	60	56.07	10	17	15.89	42	107	100

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Classification based on groups of subjects for each Surveying Engineering Program

Program	Basic Science Subjects			Common Subjects for Engineer			Specific Profesional Subjects			Cross-sectional Subjects			Total		
	Subjects	Credits	% Credits	Subjects	Credits	% Credits	Subjects	Credits	% Credits	Subjects	Credits	% Credits	Subjects	Credits	% Credits
Surveying Engineering U.D	8	25	15.43	9	23	14.2	29	81	50	16	33	20.4	62	162	100
Surveying Engineering U.V	10	29	17.9	7	18	11.11	32	90	55.6	10	25	15.4	59	162	100
Mapping Engineering U.D	9	27	16.88	8	17	10.63	31	87	54.4	17	29	18.1	65	160	100

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- The number of credits in the Engineering Programs are consistent with the suggested by the Colombian Association of Faculties of Engineering (ACOFI), i.e. between 160 and 180.
- The differences lie in the distribution of these between of the areas, according to the emphasis that each program establishes in the several fields of engineering.

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Mandatory and Elective Subjects for Surveying Technology

Program	Credits			
	Mandatory Subjects	% Credits	Elective Subjects	% Credits
Surveying Technology "U.D"	34	86.5	6	13.5
Surveying Technology "U.Q"	40	93.5	3	6.5
Surveying Technology "U.T"	34	98.1	1	1.9
Surveying Technology "U.T.S"	31	85.9	7	14.1
Geomatic Technology "U.C"	42	100	0	0

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Mandatory and Elective Subjects for Surveying Engineering

Program	Credits			
	Mandatory Subjects	% credits	Elective Subjects	% Credits
Surveying Engineering U.D	50	84.0	10	16.0
Surveying Engineering U.V	55	92.6	4	7.4
Mapping Engineering U.D	56	85.6	9	14.4

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Conclusions:

- All the academic programs of engineering and technology related to surveying are offered in public universities.

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- None of the two universities with engineering studies offer the possibility to pass from a technological program to a professional one, but in the “Universidad Distrital”, a mobility program from Surveying Technology to Surveying Engineering through a process of homologizing is being established.

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- By comparing the curricula of Engineering Programs, the Surveying Engineering program at the Universidad del Valle is the most rigid curricula because it has few elective credits: 7%, while the Surveying Engineering program of the Universidad Distrital is more flexible with 18% elective credits, which may explain why the program offers several subjects of specialization.

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Thank you!

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- Finally, there is uniformity in the curricula of technological programs. Thirteen common subjects are offered at all institutions: Planimetry, Altimetry, Drawing Surveying, Photogrammetry, Photointerpretation, Special Surveys, Hydraulic Works, Roads I, Roads II, Mapping, Civic Construction, Geodesy, and Geographic Information Systems.
- The three academic programs offered by the “Universidad Distrital” have high academic quality accreditation. The Surveying Engineering program of the “Universidad del Valle” is in the process to gain recognition for high quality accreditation; the technological level in the Surveying Technology program at the “Universidad del Tolima” is conducting the same procedure.

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- Specific Professional Subjects: Specific subjects related to the career such as statistical and fitting methods, geosciences, geography, topography and mining, and land management planning, civil engineering and construction, geodesy, photogrammetric and remote sensing, cartography, GIS, among others.
- Cross-sectional Subjects: Contents do not directly relate to engineering or technology, but offer the graduate a greater range of knowledge that will be useful during the development of his/her careers. Reference is made to subjects such as business administration and management, project management, labor law, etc”.

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- Basic Sciences - Basic sciences include subjects such as mathematics, physics, chemistry and biology
- Common Subjects for technology or engineering- To be understood as common materials and engineering technologies, related to academic areas of computer science and programming, among others.
- Cross sectional Sub and management, project management, labor law, etc”.

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