DO THE CAREERS OF THE UNIVERSIDAD MAYOR DE SAN ANDRÉS DE LA PAZ BOLIVIA INCLUDE AI IN THEIR ACADEMIC PROGRAMS?

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ABSTRACT

This research will address the current situation of the Universidad Mayor de San Andrés de La Paz, Bolivia, and its role as a trainer on the subject of Artificial Intelligence.
In this article we will not establish whether AI is good or bad in itself, what we will try to do is to show how the UMSA careers have included in their academic plans this tool that has become necessary for development in the different fields addressed by science.
To this end, we have collected the academic programs of the 56 careers offered by the University, from these programs a double-entry matrix has been developed with criteria that allow us to understand the programmatic profile of each of them.
Following the criterion given by experience for having been a peer evaluator of both plans and academic programs in the Alfa Tuning project (PATRICIA, 2021) and in MERCOSUR (Universidad Católica de Santa Fe, 2009 - 2015 countries such as Argentina, Brazil, Paraguay and Bolivia), the 56 careers have been considered, which have been segmented into 5 macrocurricular areas of learning. namely: quantitative area, formative area, complementary area, methodological area and AI as a tool for application in the university curriculum of the UMSA. Understanding of course that these macro areas are related and systemically structured in each career, but, for the present research work, they are only separated by analysis methodology.
To this end, we can start by giving greater attention to the training of teachers so that they can resort to new multidimensional strategies and real and practical application so that they can make the descent in the classrooms. Therefore, open educational resources are going to be the elements that contribute to improving and increasing skills in the field of digital technologies and that can approach the resources offered by AI.

Keywords: Artificial Intelligence, Updated Curriculum, Integration of Subjects with AI.

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INTRODUCTION

A curriculum or program is organized following criteria of sequential organization from the most basic to the complex of learning, which is why it becomes an instrument of vital importance and guidance for both teachers and especially for students, so it must be able to systemically integrate the concepts, establishing flexibility and adaptation to the permanent demands of society and the university where the plan is being applied, in this sense, one of the factors must be the integration and decomposition of the areas, seeking the approach of cognitive elements to arrive at holistic systems that conclude in the complex and deep training of the student, counting for this purpose with areas such as: quantitative, formative, complementary, methodological and AI.

In the approach to the quantitative area in the careers of the UMSA, it is evident that a large part of the careers have opted for the need to include this field in the curriculum because these careers introduce the rationalist and problem-solving approach from the abstract and quantum training of phenomena, in this area an endless number of subjects considered as the "strong" are introduced some careers with this trunk of training they give a lot of weight and other careers show greater flexibility and articulation with other areas, for which training with academic tutoring and a curriculum with clear pre-established objectives is required.

UNESCO has proclaimed World Mathematics Day in 2019, with the aim of establishing the importance of this branch of curricular training and above all to establish the contribution of the quantitative area of science in social progress and the profusion of new sources of knowledge from the application of this valuable instrument as a tool for study and learning. With this background, the quantitative area has been chosen as a reference in academic training. .(UNESCO DIRECTOR GENERAL , 2023)

The training area constitutes the trunk of training, it establishes the attribute of each of the disciplines, which gives the raison d'être to each of the careers because it allows each of the phenomena to be seen in vertical depth knowing in detail their essence, in this sense "UNESCO has worked on important concepts on the need to give a strong push to the training area: "....formative assessment has gained strength as an ideal tool to collect rich and detailed information on students' learning processes....." . (UNESCO, 2021)

As for the area of complementary subjects, they are within the field of the horizontal view of academic training, which, being subjects that complement as their name indicates, serve for the student to complete their training integrally and systemically. UNESCO texts also show that ICTs are considered as part of complementary training. (OFICINA INTERNACIONAL DE EDUCACION - UNESCO, 2017)

Regarding training in the methodological area, it can be established that they are the basis of research and innovation, topics that must be addressed from each of the disciplines considering the level of training at the different levels offered by the careers and depending on each of the students. . The tools for research, in some careers, are usually complex because some of them do not have the necessary equipment and resources to proceed with research that has scientific rigor, which ultimately seeks sustainable development for the country and the international scientific community. (UNESCO, ACTUALIZACION 2023)

Finally, within the field of academic training there is the AI variable, as an indicator of academic training in the field of e-learning, building bridges between the present, the past and the future, between formal education and distance education, between the tasks that automate the student and those that allow him to open his possibilities to infinity. This refers to the range of formal and informal activities that complete the teaching-learning process, so that students can with this training instrument arrive at more in-depth research and achieve substantive, applicable and future learning. "UNESCO affirms at its 40th session (2019) that the ICTs currently applied in e-learning are essential to reduce the digital divide. (UNESCO, 2024)

In this regard, there are several historical milestones that explain the stage from which the word artificial intelligence enters the concert of the development of humanity, certainly this process comes from the need that human beings have to project their biology in instruments that allow them to survive on earth, such as living, eating, defend themselves from other predatory beings, protect themselves and their flock, etc.

What is certain is that in the middle of the last century the term began to be coined, already linked to technology and war. Its beginning starts with the use of advanced mathematics, which will explain how the human being has in his brain a series of neural networks which allow infinite links to be established, these links become so complex that they are almost impossible to be controlled by the human being, for which the first neural computer is created in the USA in 1950, so also in the same year the Turing test was created, to assess AI, Alan Turing answered the question that we always ask ourselves: can machines think? The results that Turing was able to offer were highly convincing since a machine allowed interaction and answers to questions just like a real human being. .(Fajardo Carla de Andara, 2021)(Erin Blakemore, 2023)

From these results and new and more profuse ones, scientists dedicated their time and lives to work in the field of AI, driving its growth and development. But it was in 1956 during the Dartmouth Conference (Dartmouth Summer Research Project on Artificial

Intelligence), where a significant milestone was marked in the field of AI, which until now has served as a reference for future research. Although it is clear that this process has had ups and downs either for financial or conception reasons, today both Japan and the US have allocated many resources to continue on the path of AI, leaving the possibility that machines will increasingly replace human capacities to think and reason in their development.

THE PROBLEM

The 56 careers of the UMSA are making efforts to insert AI into their academic programs and this effort has different degrees and understanding of the dimension of its present and future usefulness.

To guide this research, the following general question has been designed:

To what extent has UMSA, with 56 degrees, managed to incorporate AI into its academic programs?

Specific objectives:

- Disaggregate UMSA careers into areas of knowledge: Quantitative, Formative, Complementary, Methodological, AI (F1)
- Systematize the way in which each of the faculties and careers arrange their curricular load and organize specific academic training. (F2, F3, F4, F5, F6, F7, F8, F9, F10, F11, F12, F13, F14)
- To analyze the current uses and possible trends in the different careers of the UMSA where it will be possible to apply AI in the future
- To induce conclusions and recommendations pertinent to the analysis of the results based on the data extracted from the curricular meshes.

THEORETICAL FRAMEWORK

AI AS A TOOL TO SUPPORT AND FACILITATE RESEARCH AND INNOVATION IN UMSA CAREERS

The University was created in order to offer the population a series of careers and faculties that allow students a professional training with the first level of a bachelor's degree and that has now achieved several levels in training until reaching the doctorate in many careers and specialties.

Since its creation, the UMSA has tried to adapt its objectives to the national, social, historical and cultural reality that the country is experiencing, being the teaching method with the greatest emphasis on positivism and developing in each specialty and career

competencies according to their study plans in such a way that the student achieves research skills in accordance with the national and international reality.

Fig. 1 describes the 13 faculties, the 56 careers and the number of subjects that the UMSA offers in each career. For this article, the subjects have been organized in the table into 5 areas: quantitative, formative, complementary, methodological and the area that brings us to this article, AI.

As for AI, it is a variable that still requires greater work in careers, so that the contributions and findings have a dialogue with technologies and that these in turn serve to contribute to the development of the country and the institutions that compose it.

METHODOLOGY

MATERIALS AND METHODS

This research work has been prepared on the basis of the Study Plans offered by the faculties and careers, systematized from the subjects that each of the careers exposes in a descriptive way, for which a mathematical count has been carried out to identify the subjects and place them in the 5 areas described.

Based on empirical experience, the mathematical count of the subjects has been carried out, establishing to which area each one belongs, this methodology has allowed us to know the profile of each career in terms of the volume of subjects that are available for each area, leaving the area of AI as a quantitative reference of how much the faculties and the UMSA in general, have defined the insertion of digital technologies in their curricula as important.

From the measurement of the areas in a descriptive way, it can be predicted that in the medium future there will be a leap where careers due to the pressure of young students and the demand of society, expressed in public and private institutions, will have to be incorporated, achieving new digital technologies applied to each specialty and career.

This research is an initial analysis where a sample of the profile of the careers is applied, however, the results can be discussed and complemented by the different careers.

Figures 2 to 14 show the profiles of the different faculties where the careers and the years in which their academic programs were developed are included, distributed at the author's discretion in the different areas.

RESULTS

ANALYSIS OF THE RESULTS ON THE CURRICULA OF THE 56 CAREERS OF THE UMSA.

Initially, this research work analyzes a quantitative evaluation of the subjects in their different components of the 56 UMSA careers, seen from the design of a double-entry matrix (Brieger, 2024), this matrix serves to contextualize and answer the research question. (Fig 1)

Figure 1. Research matrix of the 56 UMSA careers

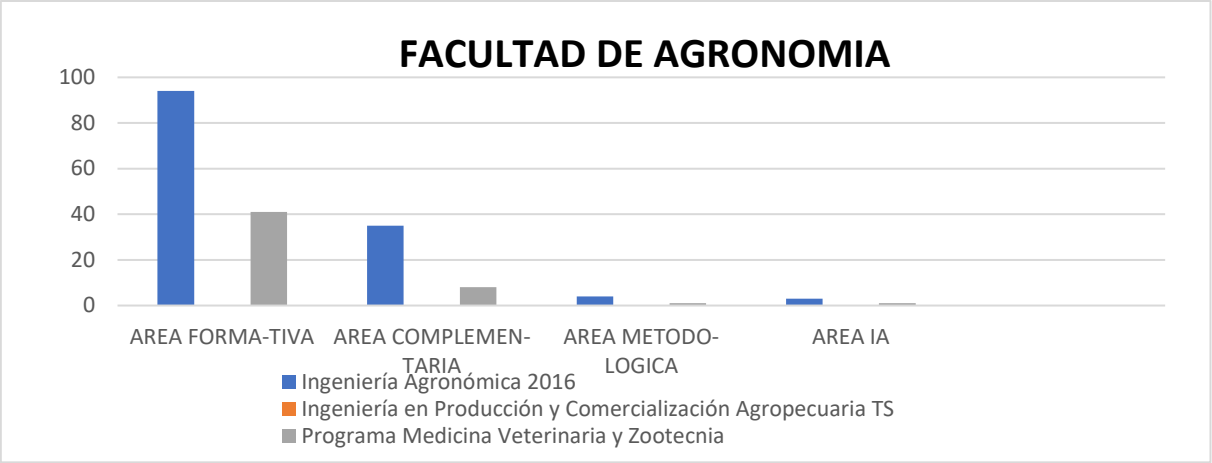
UNIVERSIDAD MAYOR DE SAN ANDRES						
FACULTADES	CARRERAS	AREA CUANTI-TATIVA	AREA FORMA-TIVA	AREA COMPLEM EN-TARIA	AREA METODO-LOGICA	AREA IA
Facultad de agronomìa	Ingeniería Agronómica 2016	4	94	35	4	3
	Ingeniería en Producción y					
	Programa Medicina Veterinaria y	1	41	8	1	1
Facultad de arquitectura, artes, diseño y urbanismo	Arquitectura 2023	3	22	2	1	2
	Artes Plásticas 2019	0	30	3	2	0
	Diseño Grafico 2013	0	25	3	2	2
	Programa de Artes Musicales					
Facultad de ciencias econòmicas y financieras	Administración de Empresas 2012	3	57	10	5	4
	Contaduría Publica 2012	4	31	1	2	3
	Economía 2012	14	49	5	6	2
Facultad de ciencias farmacèuticas y bioquìmicas	Bioquímica	2	36	2	5	1
	Química Farmacéutica	1	27	3	2	0
Facultad de ciencias geològicas	Ingeniería Geográfica 2015	7	31	4	3	2
	Ingeniería Geológica 1984	5	35	3	2	2
	Biología 2017	3	61	5	6	0
	Ciencias Químicas TS					
Facultad de ciencias puras y naturales	Estadística 2012	5	26	0	3	6
	Física 2012	10	150	8	3	9
	Informática 2022	10	26	2	5	22
	Matemáticas 2017	8	81	5	5	20
	Antropología y Arqueología 1998	0	42	6	2	2
Facultad de ciencias sociales	Ciencias de la Comunicación Social	0	19	2	4	1
	Sociología 2017	4	25	11	10	3
	Trabajo Social 2023	1	24	5	1	0
Facultad de derecho y ciencias politicas	Derecho 2019	0	25	8	2	1
	Ciencias Políticas y Gestión Publica	5	18	26	2	1
	Bibliotecología y Ciencias de la	1	30	1	3	8
	Ciencias de la Educación 2017	2	68	3	8	1
Facultad de humanidades y ciencias de la educaciòn	Filosofía 2019	1	37	9	3	0
	Historia 2017	1	21	5	3	0
	Lingüística e Idiomas 1999	0	37	4	5	0
	Literatura 2019	0	28	1	4	0
	Psicología 1984	2	44	6	5	0
	Turismo 2018	2	35	12	3	0
Facultad de ingenierìa	Ingeniería Civil 2019	24	39	8	5	1
	Ingeniería Electrónica 2000	11	26	2	3	10
	Ingeniería Eléctrica 1982	16	24	6	3	3
	Ingeniería Industrial 2015	11	28	9	3	2
	Ingeniería Mecánica y Electromecánica	17	30	12	1	6
	Ingeniería Metalúrgica y Materiales 2020	18	28	5	2	1
	Ingeniería Petrolera 2017	25	30	8	2	2
	Ingeniería Química 2013	11	27	4	3	1
Facultad de medicina , enfermerìa, nutriciòn y tecnologìa mèdica	Medicina 2001	1	21	6	0	0
	Enfermería 2017	1	20	4	3	0
	Nutrición y Dietética 2010	2	18	8	3	1
	Tecnología Médica 2017 TS					
acultad de odontolog	Odontología 2017	1	30	4	1	0
	Aeronáutica 2012	8	25	11	1	2
	Construcciones Civiles TS					
	Electricidad Industrial 2017	8	31	6	2	2
	Electrónica y Telecomunicaciones 2012	9	17	9	3	20
acultad de tecnologì	Electromecánica 1995	8	30	5	4	2
	Mecánica Automotriz 1998	9	26	11	3	7
	Mecánica Industrial 2017	6	30	11	3	2
	Química Industrial 2005	10	29	4	3	4
	Geodesia, Topografía y Geomática TS					

Source: Authors, with data on the careers published on the website

UMSA careers address digital technologies in different ways and in different degrees of interest and depth. Another factor that shows the differences in the approach to AI is the date on which the careers have held their Academic Conferences, which in some cases date back 3 decades, in this long period it is very difficult for them to update and make changes aimed at AI training in the different disciplines.

Graphing the quantitative situation summarized in Fig. 1, the 13 faculties of the UMSA can be observed more specifically as follows:

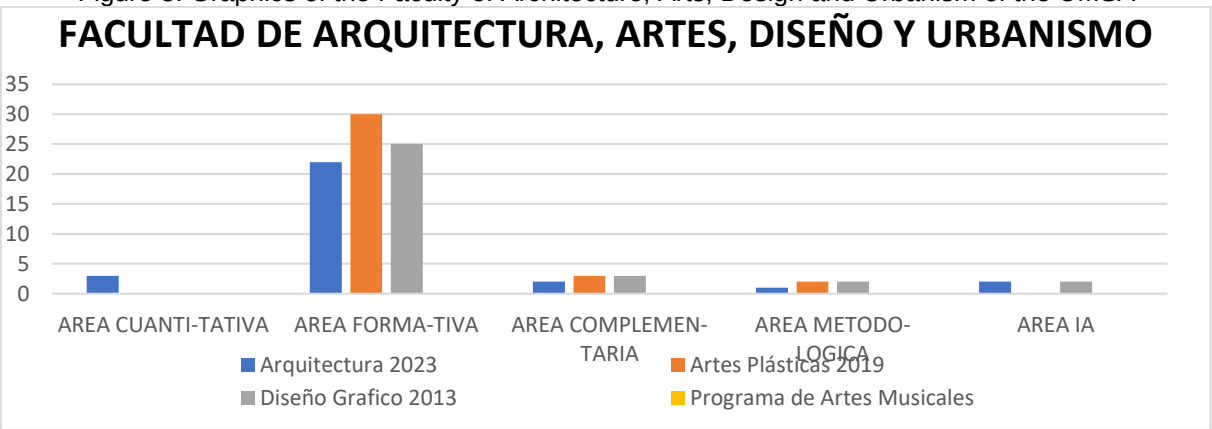
Figure 2. Graph of the Faculty of Agronomy of the UMSA



Source: Authors, official data published on the UMSA website – 2016

The careers of the Faculty of Agronomy, according to the data extracted, give greater emphasis to the training and complementary area, in its two careers with a bachelor's degree, as its Study Plan was approved in (2016) very little workload has been allocated to AI.

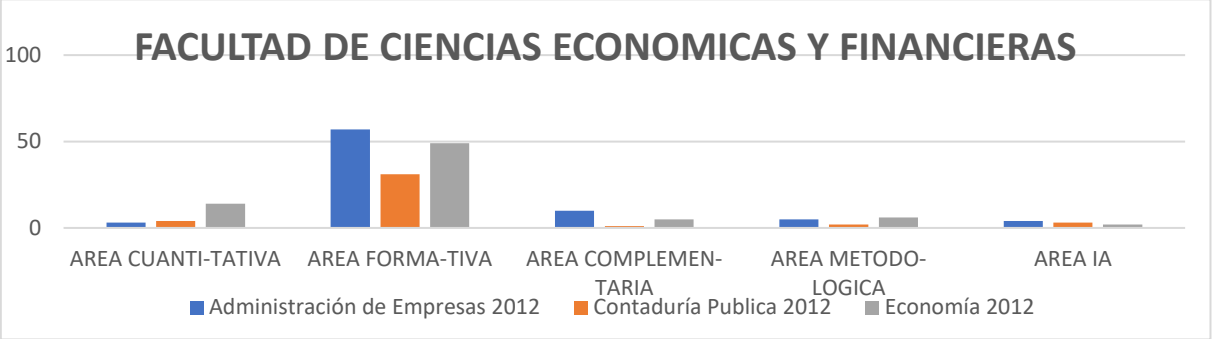
Figure 3. Graphics of the Faculty of Architecture, Arts, Design and Urbanism of the UMSA



Source: Own elaboration, official data published on the UMSA website – Architecture 2023, Plastic Arts 2019 and Graphic Design 2013

The Faculty of Architecture has 3 careers and a Higher Technician in Musical Arts, all these careers give greater emphasis to the formative and complementary area, AI training is attended to a lesser degree by the careers of Architecture and Graphic Design, however, some teachers have begun to use some programs such as Chat GPT, a tool that has become an assistant and support to teaching. The inclusion of AI in the academic curriculum is not reflected in the curricula.

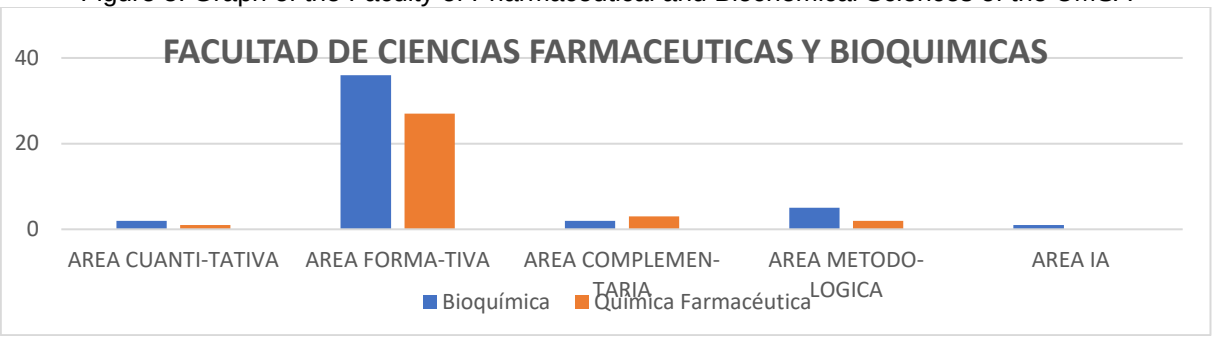
Figure 4. Graph of the Faculty of Economic and Financial Sciences of the UMSA



Source: Authors, official data published on the UMSA website – Business Administration 2012, Public Accounting 2012 and Economy 2012.

The careers that make up the Faculty of Economic and Financial Sciences show a marked bias in the area of academic training, giving space to the quantitative and complementary areas in a scarce way, the same is observed in the methodological area and in AI, this is possible that this is due to the fact that their academic programs have been approved in the 2012 management.

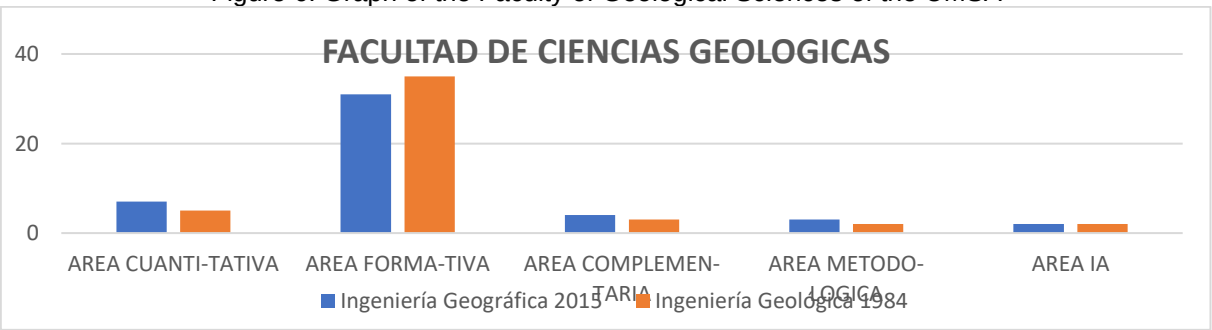
Figure 5. Graph of the Faculty of Pharmaceutical and Biochemical Sciences of the UMSA



Source: Authors, official data published on the UMSA website

The Faculty of Pharmaceutical Sciences and Biochemistry has not included on the website the date of updating its Study Plans, it is assumed that they also come from past administrations since in the academic profile there is a greater emphasis on the training area. It is also evident that a minimum of academic hours have been allocated to AI.

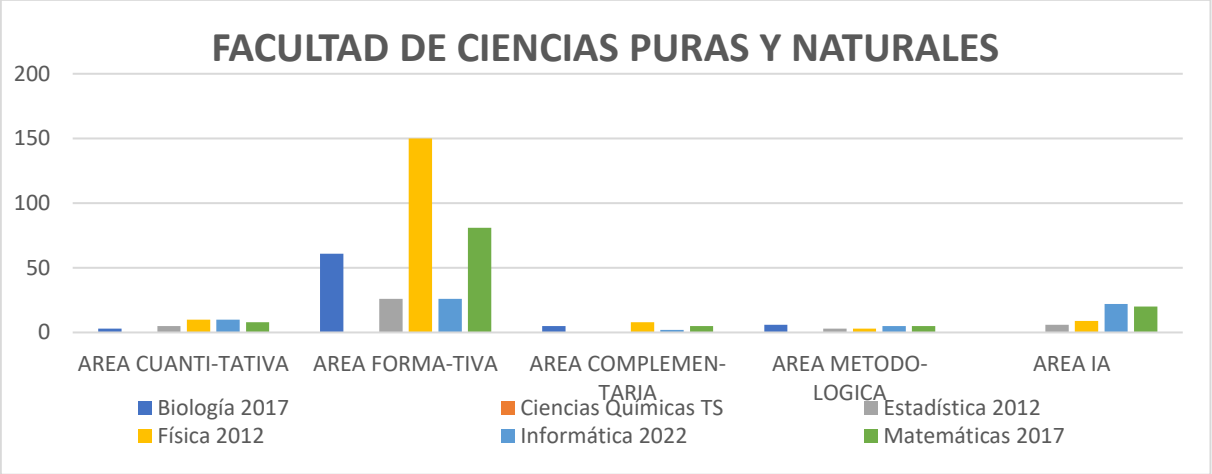
Figure 6. Graph of the Faculty of Geological Sciences of the UMSA



Source: Authors, official data published on the UMSA website – Geographical Engineering 2015 – Geological Engineering 1984

The academic profile of the Geographic Engineering and Geological Engineering careers shows the degree of importance that the careers give to the training area. In the case of Geography, there is evidence of an interest in the quantitative area, due to the specialty. In the curricula of the two careers, it is not observed that more space has been allocated to AI, which has approved its curriculum for more than 30 years.

Figure 7. Graph of the Faculty of Pure and Natural Sciences of the UMSA



Source: Authors, official data published on the UMSA website – Biology 2017, Physics 2012, Computer Science 2022, Mathematics 2017.

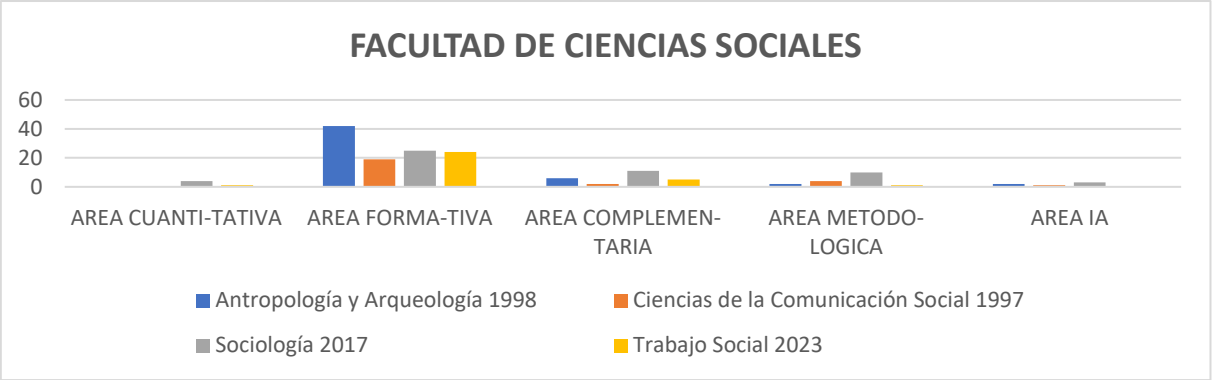
The academic profile of Biology 2017 shows an emphasis on the training area, we find an interesting distribution in the different areas, although AI has not yet been addressed as a tool for academic training.

As for Physics, despite the number of subjects, it has managed to address all areas, including an interesting component in AI training.

The Computer Science career has achieved a greater balance between its areas of study in a systemic way, thus, it has not neglected AI training.

Like the Computer Science career, the Mathematics career has achieved a systemic balance in all areas of knowledge, without neglecting AI, despite the fact that its Curriculum dates back to 2017.

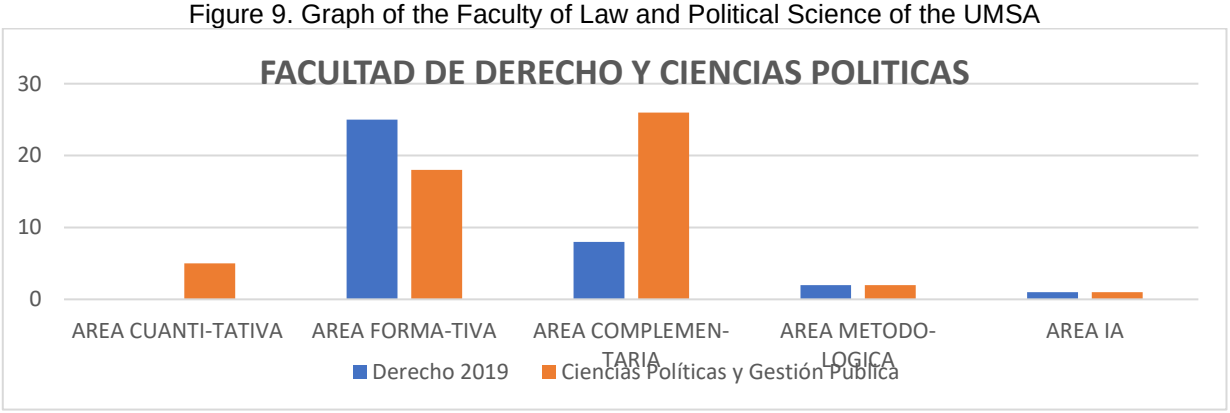
Figure 8. Graph of the Faculty of Social Sciences of the UMSA



Source: Authors, official data published on the UMSA website – Anthropology and Archaeology 1998, Social Communication Sciences 1997, Sociology 2017, Social Work 2023.

Although social careers give greater emphasis to the training area, two areas are worked on with interest, such as the complementary and methodological areas, the latter as a basic instrument and cognitive complementarity to build research questions and hypotheses, in this social context the use of instruments such as AI is evident.

Figure 9. Graph of the Faculty of Law and Political Science of the UMSA



Source: own elaboration, official data published on the UMSA portal – Law Degree 2019, and Political Science and Public Management.

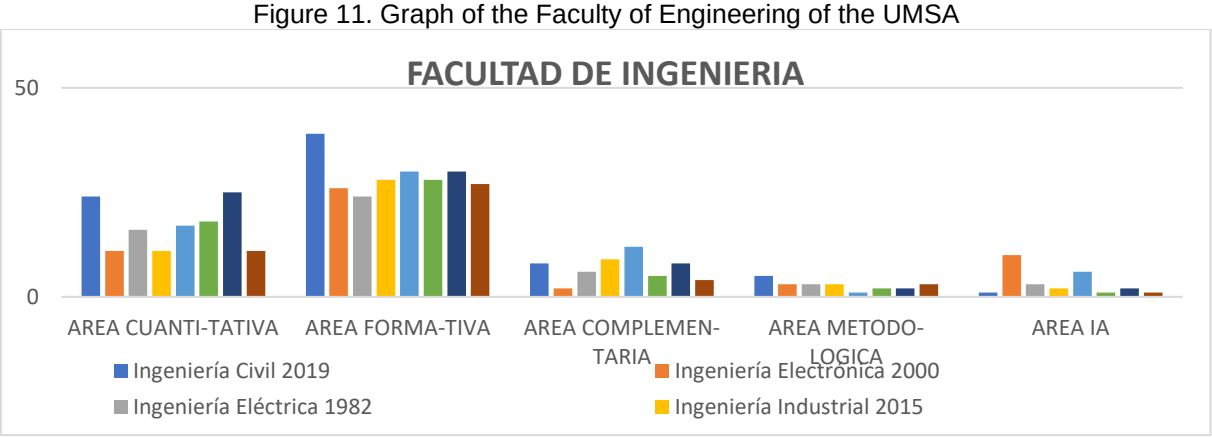
Both the Law and Political Science degrees have included a smaller contingent of AI-related subjects in their curricula, a fact that shows that they have been updated to the current needs of comprehensive training.

Figure 10. Graph of the Faculty of the Faculty of Humanities and Education Sciences of the UMSA

Source: Authors, official data published on the UMSA website – Careers of: Library and Information Sciences 2020, Philosophy 2019, Linguistics and Languages 1999, Psychology 1984, Education Sciences 2017, History 2017, Literature 2019 and Tourism 2018

One of the careers that shows the greatest interest in AI training is the Library and Information Sciences career, possibly because it has updated its Study Plan in 2020, an important effort, similar actions are also evident in the Education Sciences career.

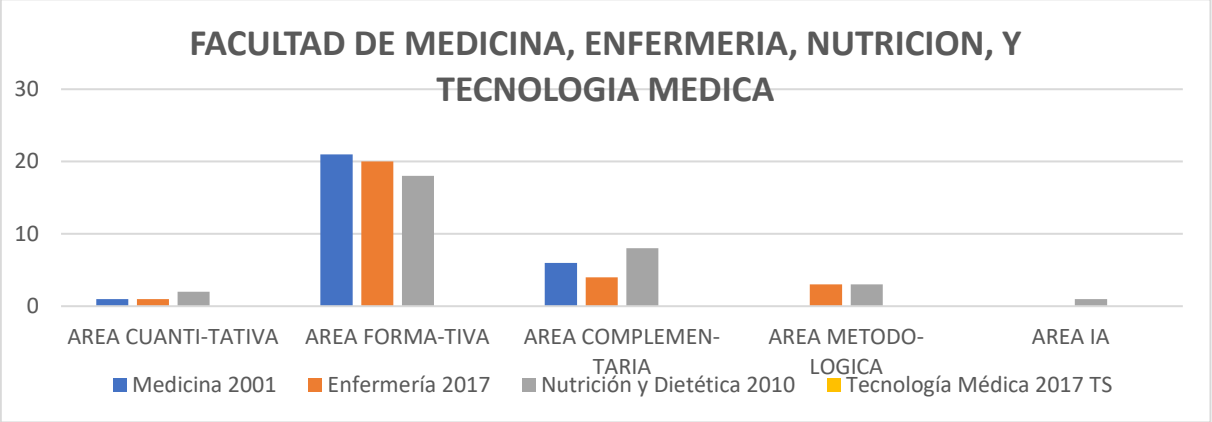
Figure 11. Graph of the Faculty of Engineering of the UMSA



Source: Authors, official data published on the UMSA website – Careers of: Civil Engineering 2019, Electronic Engineering 1982, Mechanical and Electromechanical Engineering 1995, Petroleum Engineering 2017, Electronic Engineering 2000, Industrial Engineering 2015, Metallurgical Engineering and Materials 2020 and Chemical Engineering 2013.

It is not surprising to anyone that the Faculty of Engineering of the UMSA has aimed its academic training by integrating the 5 areas in a systemic way and on the other hand giving a push in the application of AI, rescuing the Electronic Engineering Career as a pioneer and with the greatest impact in the area, as well as the Mechanics and Electromechanics career. despite the fact that its curriculum was approved in 1995, the attempts of Electrical, Industrial, Petroleum and Chemical Engineering are also rescued.

Figure 12. Graph of the Faculty of the UMSA



Source: Authors, official data published on the UMSA website – Careers of: Medicine 2001, Nursing 2017, Nutrition and Dietetics 2010, Medical Technology 2017 (TS)

The Faculty of Medicine has developed a similar form of academic training in its 3 careers and in its Higher Technician, there is evidence of an important bias in the training area, and complementary, the other areas are addressed marginally, as well as AI.

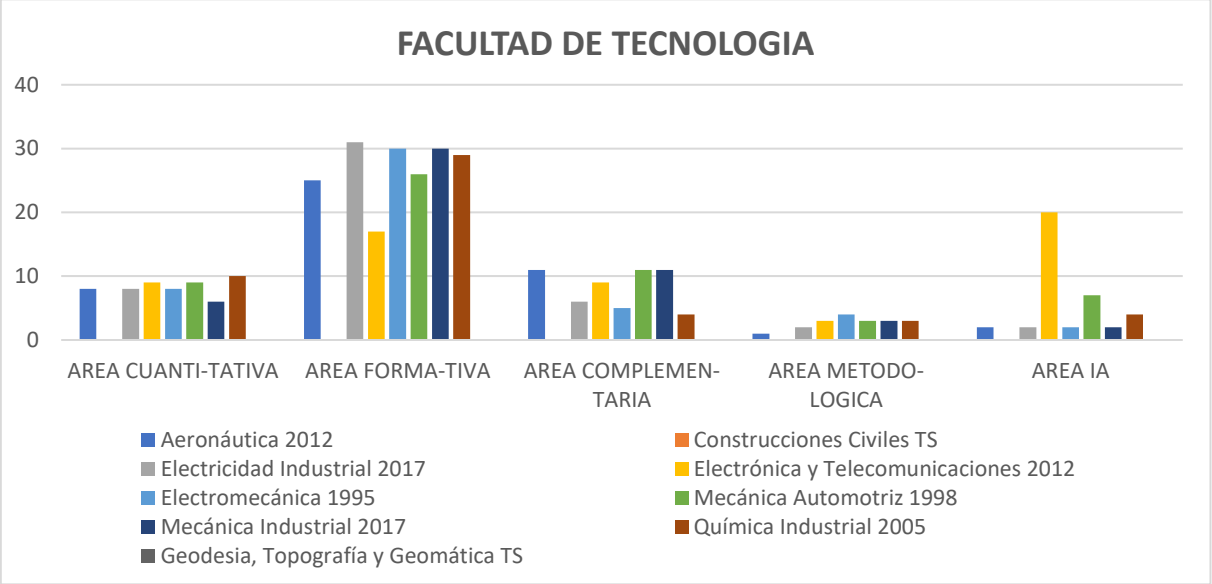
As it is a Faculty that is very sensitive to the conditions and the relationship with human life, the careers that make it up must consider fundamental aspects that allow its updating and relationship with patients in an effective and empathetic way with technological advances.

Figure 13. Graph of the Faculty of Dentistry of the UMSA

Source: Authors, official data published on the UMSA website – Career: Dentistry 2017

The Faculty of Dentistry has opted for a career with depth in training, with a vertical view in academic training, leaving aside the systemic that the horizontal view could give to careers, for this reason there is no evidence of a greater academic space in the quantitative, methodological and AI areas.

Figure 14. Graph of the Faculty of Technology of the UMSA



Source: Authors, official data published on the UMSA website – Careers of: Aeronautics 2012, Industrial Electricity 2017, Electromechanics 1995, Industrial Mechanics 2017, Electronics and Telecommunications 2012, Automotive Mechanics 1998, Industrial Chemistry 2005.

The Faculty of Technology has fully developed its academy proposals, allocating a good number of subjects to complementary training to training, as well as to the quantitative and methodological area, in such a way that it can acquire horizontal and systemic knowledge, as well as an in-depth vision where it can be supported by the advances and contributions of AI.

CONCLUSION

Careers and faculties can voluntarily and systematically update their curricula on a regular basis by cohorts, this allows the plans to be updated and to be competitive both with the environment and with the countries of the region and the world.

The faculties and careers of the UMSA are in a slow process of insertion of AI and therefore lag behind the region and the rest of the world.

The UMSA must prepare itself in all academic/training areas to break with traditional educational models and partly in the process of obsolescence.

Better results can be achieved in generational and gender gaps if the AI variable is incorporated into academic training.

The new forms of communication and information are based and will be based with greater emphasis in the future on AI-based instruments for each discipline, therefore, it will be necessary to investigate and propose new functional paths for each career and faculty of the UMSA.

Technical and technological careers and faculties have worked with greater emphasis on the educational opportunities and advantages offered by AI.

With the mathematical count of the subjects of the 56 careers, it has been possible to establish that the research question can be answered by establishing that the careers are incorporating AI very slowly into their curricula, being a current need and that in the future it will determine the improvement of academic quality integrally.

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