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Resultados de la evaluación del modelo educativo para la formación por competencias laborales en los alumnos de la División de Ingenierías de la Universidad de Guanajuato

Results of the Evaluation of the Educational Model for the Training by Labor Competences in the Students of the Engineering Division of the University Of Guanajuato

Resultados da avaliação do modelo educacional para a formação por competências laborais nos alunos da Divisão de Engenharia da Universidade de Guanajuato

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Resumen

Este artículo presenta los resultados de una investigación llevada a cabo en la División de Ingenierías de la Universidad de Guanajuato (UG), Campus Guanajuato, y cuyo objetivo general fue evaluar la implementación del modelo educativo para la formación por competencias laborales en los alumnos, así como determinar el impacto que tuvo la actualización curricular de los programas educativos. Esto con la finalidad de definir las acciones que se deben realizar para que los docentes cuenten con las competencias genéricas especificadas en el Modelo Educativo de la UG.

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Se seleccionó una muestra de 1460 alumnos de un total de 1722 estudiantes que estuvieron inscritos en los diferentes programas educativos de la división ya mencionada en el semestre enero-junio de 2015. Esta muestra y las técnicas e instrumentos utilizados para la recolección de la información, al igual que el método de análisis factorial, facilitaron la consecución de las metas planteadas.

Entre las conclusiones se resalta la importancia de diseñar, aplicar y evaluar programas de intervención tanto para estudiantes como para profesores capaces de modificar, en cada caso, los enfoques de enseñanza-aprendizaje, así como de contar con una herramienta educativa que permita desarrollar en el alumno el afán de búsqueda y de creatividad para alcanzar una mejor comprensión de los fenómenos y facilitar el aprendizaje y la práctica misma de los conocimientos.

Palabras clave: competencias del egresado, modelo educativo, práctica docente.

Abstract

The present article shows the results of a research carried out in the Engineering Division of the Guanajuato University and whose main purpose was to evaluate the implementation of the Educational Model focused in training students for labor competencies, as well as to determine the impact that had the curricular update of the educational programs. This with the purpose of defining the actions that must be carried out so that the teachers have the generic competences required by the University of Guanajuato.

A sample of 1460 from a total of 1722 undergraduate students was selected from the division above mentioned. This sample the techniques and instruments used to collect the information, as well as the method of analysis factor, allowed the achievement of the goals set.

Among the conclusions it is highlighted the importance of designing, applying and evaluating intervention programs for both students and teachers capable of modifying, in each case, the teaching-learning approaches, as well as having an educational tool that allows to develop in the student the desire for search and creativity to achieve a better understanding of the phenomena and facilitate not only learning, but the practice of knowledge.

Keywords: graduates competencies, educational model, teaching practice.

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Resumo

Este artigo apresenta os resultados de uma pesquisa realizada na Divisão de Engenharia da Universidade de Guanajuato (UG), Campus Guanajuato, e cujo objetivo geral foi avaliar a implementação do modelo educacional de formação por habilidades profissionais em estudantes, bem como como determinar o impacto da atualização curricular de programas educacionais. Isso com o objetivo de definir as ações que devem ser realizadas para que os professores tenham as competências genéricas especificadas no Modelo Educacional da UG.

Uma amostra de 1460 alunos foi selecionada de um total de 1722 alunos que estavam matriculados nos diferentes programas educacionais da divisão já mencionados no semestre de janeiro a junho de 2015. Esta amostra e as técnicas e instrumentos usados para coletar as informações, Como o método de análise fatorial, eles facilitaram o alcance das metas estabelecidas.

As conclusões destacam a importância de projetar, aplicar e avaliar programas de intervenção para alunos e professores capazes de modificar, em cada caso, as abordagens de ensino-aprendizagem, bem como ter uma ferramenta educacional que permita desenvolver no aluno o desejo de busca e criatividade para alcançar uma melhor compreensão dos fenômenos e facilitar o aprendizado e a prática do conhecimento.

Palavras-chave: competências do graduado, modelo educacional, prática docente.

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Introduction

Planning a learning scenario involves considering as many variables as possible aimed at the achievement and construction of the students' integral competences: academic, disciplinary, transversal, attitudinal and action, considering a creative and innovative work from the practice of the teacher to achieve such a purpose

The projects are an option to link all the curricular contents and the experiences worked inside and outside the classroom to build educational competences that can be applied in the student's daily life. And a comprehensive project is one that is carried out from a disciplinary area

in order to make connections with other subjects and learning experiences to stimulate meaningful learning in students. It is based, of course, on the implementation of teaching, creative and critical skills (U. G., 2018).

Regarding educational innovation, it is about the possibility of recreating situations that, according to the context, surprise the participants favorably. In short, build scenarios in which different strategic possibilities for the learning of students and teachers are explored (Universidad de Guanajuato, 2011).

In Mexico, since 1991, the universities belonging to the National Association of Universities and Institutions of Higher Education (Anuies) agreed to foster a culture of evaluation as a basis for obtaining improvements in all their educational processes. Subsequently, they agreed on quality criteria in the institutional sphere and, with this fundamental agreement, they worked systematically and obtained concrete and visible achievements.

The University of Guanajuato (UG) has shown a constant rhythm to achieve this common purpose and has placed itself in a distinctive place within the national university environment. To reach this level, the UG has deployed a participatory planning exercise extended to the entire community and, in its governing bodies, a comprehensive management effort that includes the growth of enrollment, its quality indicators and its infrastructure. This has been achieved thanks to the remarkable academic growth in practically all of its areas, which has allowed it to double its budget in the last six years, especially through the extraordinary funds of the federal and state governments. (UG, 2018).

However, this prosperous university environment can not limit learning to unidisciplinary issues, but it must strengthen and propitiate what is necessary to learn in a multidisciplinary field, and thus favor the comprehensive analysis of transcendental study objects that enable students to achieve their competencies. generic and specific (University of Deusto / University of Groningen, 2007). At the same time, this environment should promote the university values expressed in its code of ethics (UG, 2018).

The Educational Model of the UG is derived from the Institutional Development Plan (Pladi) 2010-2020, which seeks to address the aforementioned concern, and is structured in three levels: conceptual, executive and operational. The elements that compose it are the following: the student, who is the center of the model; the teacher; learning and evaluation; the investigation; the

administration; the quality, certification and innovation; the processes of planning, coordination and evaluation; the bonding; internationalization, and physical infrastructure and equipment.

Based on what has been said up to this point, the following research question arose: How will the student adapt to this ideology and thereby contribute not only to the development of their student and professional competences, but also of society itself? Therefore, the study focused on analyzing these elements, taking as reference the undergraduate students of the Engineering Division of the Guanajuato Campus of the UG to establish the means to reach this end.

In such a way that the general objective of this research was focused in evaluating the implementation of the Educational Model for the training by labor competences in the students of the Engineering Division of the Guanajuato Campus of the UG. While the specific objectives were the following: 1) update the curriculum of the educational programs of the Engineering Division to comply with the new educational model of the UG and 2) determine the actions to be carried out so that teachers are trained to carry out their work based on the Educational Model of the UG and develop their teaching work for the benefit of students with a competency-based training approach.

Materials and methods

To perform the analysis of the data obtained in the application of the instruments in the sample of the students of the Engineering Division of the Campus Guanajuato, the statistical package Statistical Product and Service Solutions (SPSS), version 22.0 was used. For the type of items of the instrument applied and the variables studied, to identify their knowledge and understanding of the Educational Model of the UG, as well as their development perspective within this institution, the statistical method of factorial analysis was selected, since it is a ideal data reduction technique to find homogeneous groups of variables from a large set of variables. These homogeneous groups are formed with the variables that correlate a lot with each other and trying, initially, that some groups are independent of others (IBM, 2015).

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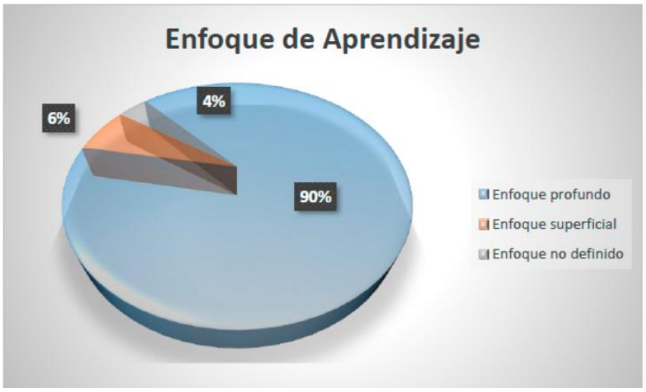
Description and exploration of learning approaches of the study sample

Study participants are cataloged in each of the approaches when they meet certain established criteria (Biggs, 2001). According to the same Biggs (2001), the students who have a score higher than the average in the scales that make up the deep focus, and at the same time lower than the average in the scales of the superficial approach, adopt a deep focus exclusively. While yes, meeting the criterion of being superior in the scales of deep focus, is found in the average of the scales of the superficial one, the students adopt a predominant deep focus. Students who meet the inverse case adopt an exclusive and predominant surface approach, respectively.

The verification of the listed criteria classifies the sample (n = 1233) into three groups: 1) students who adopt a deep focus (89.9%), 2) students who adopt a superficial approach (6.5%) and 3) students who they do not show a specific approach (3.6%) (see figure 1).

Figura 1. Enfoque de aprendizaje



Fuente: Elaboración propia

The averages of the subscales of the deep focus are always higher than in the subscales of the superficial approach (see table 1).

Tabla 1. Enfoques de aprendizaje

Subescala	χ (media)	σ (Desviación estándar)
Motivos profundos	4.09	2.37
Estrategias profundas	2.75	2.46
Motivos superficiales	-2.48	3.25
Estrategias superficiales	-1.12	3.34
Enfoque profundo	6.84	4.31
Enfoque superficial	-3.60	6.04

Fuente: Elaboración propia

The subscale of deep motives (= 4.09; = 2.37) has the highest average according to the classification, followed by the subscale of deep strategies (= 2.75; = 2.46), the subscale of superficial strategies (= -1.12) ; = 3.34) and finally the subscale of surface motifs (= -2.48; = 3.25). On the other hand, the deep focus scale has a mean () of 6.84 and a standard deviation () of 4.31 in contrast to the surface approach that has a mean () of -3.60 and a standard deviation ().) of 6.04.

Regarding the subscales of motivation of learning, it is determined that, of the students surveyed, 89.9% have a deep motivation; 6.5% of students have a superficial motivation, and only 3.6% of students have no motivation.

With regard to the subscales of learning strategies, 75.4% of students say they have deep strategies; 12.6% declare having superficial strategies, and 12% of the students do not have any preference for any strategy (figure 2).

Figura 2. Estrategia de aprendizaje

Fuente: Elaboración propia

In summary, it can be observed that the students have a high relation (90%) in terms of the motivation for the study and use deep strategies towards considerable study (75%). So it is inferred that learning for the sample of students is an emotionally pleasing and qualitative conception, whose motivation is based on the interest, understanding and importance of the subjects, and for which they use strategies that allow them to plan in an adequate and efficient way the tasks to be carried out, thanks to all this, once again, make this experience a pleasant and personal enrichment (Hernández, Martínez, Da Fonseca and Rubio, 2005).

Factorial data analysis

When the collection of a large number of variables is carried out simultaneously, for example, in a job satisfaction questionnaire, you may be interested in finding out if the questions in the questionnaire are grouped in a characteristic way. Applying a factorial analysis to the subjects 'answers, you can find groups of variables with common meaning and in this way reduce the number of dimensions needed when explaining the subjects' answers (IBM, 2015).

The factor analysis is, therefore, a technique to reduce the dimensionality of the data. Its ultimate purpose is to find the minimum number of dimensions capable of explaining the maximum information contained in the data.

Unlike what happens in other techniques, such as analysis of variance or regression analysis, in the factorial analysis all the variables of the analysis fulfill the same role: they are all independent in the sense that there is no a priori conceptual dependence of some variables over others (IBM, 2015).

In this process the following analyzes were carried out[1]:

- Deep motive subscale. Taking as a base items 1, 5, 9, 13 and 17 of the questionnaire applied to determine the deep reasons; that is, students' intrinsic interest in study habits.
- Sub-scale of deep strategies. Taking as a base items 2, 6, 10, 14 and 18 of the questionnaire applied to determine the deep strategies; that is, the search for students' maximum understanding of study habits.
- Subscale of surface motives. Taking as a base items 3, 7, 11, 15 and 19 of the questionnaire applied to determine the surface motives; that is, the fear of students' failure to study habits.
- Subscale of superficial strategies. Taking as a base items 4, 8, 12, 16 and 20 of the questionnaire applied to determine surface strategies; that is, the fear of students' failure to study habits.
- Deep focus. Based on items 1, 2, 5, 6, 9, 10, 13, 14, 17 and 18 of the questionnaire applied to determine the deep focus; that is, a combination between the deep motivation subscale and the deep strategy.
- Surface focus. Taking as a base items 3, 4, 7, 8, 11, 12, 15, 16, 19 and 20 of the questionnaire applied to determine the surface approach; that is, a combination between the surface motivation subscale and the surface strategy.

Because factor analysis is a data reduction technique used to find homogeneous groups of variables from a large set of variables, as has already been mentioned, it has been proved in this project that the subscales established are homogeneous, as well as the formation of variables that are highly correlated with each other, initially trying to make the subscales independent. When the factorial analysis was applied to the subjects 'answers, groups of variables with common meaning

[1] Se puede consultar el artículo "Evaluación del Modelo Educativo para la formación por competencias laborales en los alumnos de la División de Ingenierías de la Universidad de Guanajuato", de la revista *Electrónica sobre Tecnología, Educación y Sociedad*, para mayor referencia del análisis seleccionado.

could be found and, in this way, reduce the number of dimensions needed to explain the subjects' responses.

Fundamentally, what was proved is that with the factorial analysis it is possible to simplify the information provided by a matrix of correlations to make it more easily interpretable and that with the application of the analysis that objective was achieved.

Perception of the students regarding their academic and integral preparation

In the Educational Model of the UG, the student is the main agent of the educational process, participates actively and responsibly in the construction of their learning and in environments that go beyond the classroom during their university training course (UG, 2011). Based on this, the generic competences that all university students must acquire in their educational process in conjunction with the specific competences of their professional career are determined.

The variable "generic competence" is applied in the questionnaire to the sample of the students of the Engineering Division of the Campus of Guanajuato. Such an instrument is made up of four parts. The first consists of two Likert-type questions; the second discloses the 30 generic competences implicit in the document and asks the student to assess with a scale of 1 to 4 the importance assigned to each of them and the level of development acquired; the third part asks to list from 1 to 5 the competences considered most important according to priority, and the fourth part of the questionnaire invites to order the 17 generic competences proposed by educational psychologists in the instrument by personal assessment using a ranking that goes from 1 to 17.

The questionnaire was analyzed according to the parts already mentioned, which is why the description of the two initial questions began. In turn, the analysis was performed in relation to the sample.

Regarding the first question, namely, "Do you think the training you are receiving at the University is adequate?", 68.10% of the students chose the option "Partially" and 31.90% the option "Completely" (see table 2).

Tabla 2. Percepción de la formación adecuada en la universidad

		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	1.00	840	68.1	68.1	68.1
	2.00	393	31.9	31.9	100.0
	Total	1233	100.0	100.0	

Fuente: Elaboración propia

It should be mentioned that 68.10% of the participants consider that the training they are receiving at the university is adequate.

Regarding the second question, "Do you know the different professional activities of your career?", 52.10% chose the option "Partially", 44.00% chose the option "Completely" and 4.00% chose the option "Almost nothing". From the above it is concluded that more than 50% of the respondents consider that they know some options of the professional activities of their career, percentage that coincides with accuracy to the one obtained in the first question, referred to the quality of the university education received, (table 3).

Tabla 3. Porcentaje del conocimiento de actividades profesionales

		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	0.00	49	4.0	4.0	4.0
	1.00	642	52.1	52.1	56.0
	2.00	542	44.0	44.0	100.0
	Total	1233	100.0	100.0	

Fuente: Elaboración propia

And returning to the first question, the option "Partially" was chosen by the majority of the students surveyed, as already mentioned; but it should be noted that the options "Almost nothing", "Nothing" and "I do not know" were not selected by any student.

The average difference between the answers of the surveyed students is verified by applying the Student t-statistic with a confidence interval of 95%, thanks to which it could be concluded that there are significant differences between the means of the students' answers (table 4).

Tabla 4. Prueba de muestra única

	Valor de prueba = 0					
	t	**gl**	**Sig. (bilateral)**	**Diferencia de medias**	**95 % de intervalo de confianza de la diferencia**	
					Inferior	Superior
Pregunta 1	99.332	1232	.000	1.31873	1.2927	1.3448
Pregunta 2	86.933	1232	.000	1.39984	1.3682	1.4314

Fuente: Elaboración propia

As in the first question, in the second question "Nothing" and "I do not know" were not selected by the students. And here too we wanted to know if there was a difference in mean between the students 'answers and the t-Student statistic was applied with a confidence interval of 95%: the results show that there are significant differences between the means of the students' answers (see table 4 again).

Perception of the students with respect to the generic training competences

Regarding the second part of the questionnaire,[2] referred to the presentation of 28 competences and their respective quantification from 1 to 4 depending on the importance given to each of them, as well as the level of development acquired, it can be mentioned that in the first situation (related to the importance of the competition), those that present the highest frequencies and therefore the best valued are the following: "Motivation of achievement" (987 students), "Maintains a respectful attitude toward interculturality and diversity of beliefs, values, ideas and

[2] Los alumnos tenían la posibilidad de seleccionar más de una competencia.

social practices to promote spaces of academic and professional coexistence "(939 students)," Decision making "(938 students)," Ethical commitment "(937 students) and" Concern for quality "(936 students) (see table 5).

Tabla 5. Competencias genéricas más importantes

Importancia	Competencia	Núm. de alumnos
1	Motivación de logro	987
2	Mantiene una actitud respetuosa hacia la interculturalidad y la diversidad de creencias, valores, ideas y prácticas sociales para promover espacios de convivencia académica y profesional	939
3	Toma de decisiones	938
4	Compromiso ético	937
5	Preocupación por la calidad	936

Fuente: Elaboración propia

In the second situation, in the one referred to the level of development acquired, the competencies with the highest frequencies are "Motivation of achievement" (640 students), "Ethical commitment" (640 students), "Concern for quality" (639 students)), "Initiative and Entrepreneurship" (590 students) and "Ability to adapt to new situations" (493 students) (see table 6).

Tabla 6. Competencias genéricas con mayor nivel de desarrollo

Importancia	Competencia	Núm. de alumnos
1	Motivación de logro	640
2	Compromiso ético	640
3	Preocupación por la calidad	639
4	Iniciativa y espíritu emprendedor	590
5	Capacidad para adaptarse a nuevas situaciones	493

Fuente: Elaboración propia

It is noteworthy that the competencies "Motivation of achievement", "Ethical commitment" and "Concern for quality" are among the five preferred in both cases.

In the same way as in the previous section, we wanted to check the existence of differences between the answers of the participants, for which the comparison of means was carried out through the t-Student statistical for independent samples with a confidence interval of 9 5% (table 7).

Tabla 7. Prueba de muestra única*

Habilidad/Competencia	Valor de prueba = 0					
	t	gl	Sig. (bilateral)	Diferencia de medias	95% de intervalo de confianza de la diferencia	
					Inferior	Superior
Planifica su proyecto educativo y de vida de manera autónoma bajo los principios de libertad, respeto, responsabilidad social y justicia para contribuir como agente de cambio al desarrollo de su entorno/Importancia	237.246	1232	0	3.6813	3.6508	3.7117
Planifica su proyecto educativo y de vida de manera autónoma bajo los principios de libertad, respeto, responsabilidad social y justicia para contribuir como agente de cambio al desarrollo de su entorno/Nivel	221.291	1232	0	3.2417	3.2129	3.2704
Se comunica de manera oral y escrita en español y en una lengua extranjera para ampliar sus redes académicas, sociales y profesionales que le permitan adquirir una perspectiva internacional/Importancia	135.985	1232	0	3.4818	3.4315	3.5320
Se comunica de manera oral y escrita en español y en una lengua extranjera para ampliar sus redes académicas, sociales y profesionales que le permitan adquirir una perspectiva internacional/Nivel	101.782	1232	0	2.4769	2.4291	2.5246
Maneja ética y responsablemente las tecnologías de la información para agilizar sus procesos académicos y profesionales de intercomunicación/Importancia	159.075	1232	0	3.3998	3.3579	3.4418
Maneja ética y responsablemente las tecnologías de la información para agilizar sus procesos académicos y profesionales de intercomunicación/Nivel	144.266	1232	0	2.9586	2.9184	2.9989
Sustenta una postura personal sobre temas de interés y relevancia general, considerando otros puntos de	218.390	1232	0	3.5604	3.5284	3.5924

vista de manera crítica, respetuosa y reflexiva/Importancia						
Sustenta una postura personal sobre temas de interés y relevancia general, considerando otros puntos de vista de manera crítica, respetuosa y reflexiva/Nivel	172.379	1232	0	3.0803	3.0452	3.1153
Elige y practica estilos de vida saludables que le permiten un desempeño académico y profesional equilibrado/Importancia	193.338	1232	0	3.5207	3.4850	3.5564
Elige y practica estilos de vida saludables que le permiten un desempeño académico y profesional equilibrado/Nivel	109.944	1232	0	2.7972	2.7473	2.8472
Mantiene una actitud respetuosa hacia la interculturalidad y la diversidad de creencias, valores, ideas y prácticas sociales para promover espacios de convivencia académica y profesional/Importancia	246.755	1232	0	3.7218	3.6922	3.7514
Mantiene una actitud respetuosa hacia la interculturalidad y la diversidad de creencias, valores, ideas y prácticas sociales para promover espacios de convivencia académica y profesional/Nivel	161.947	1232	0	3.1995	3.1608	3.2383
Es sensible al arte y participa en la apreciación e interpretación de sus expresiones en distintos géneros que promuevan su formación integral/Importancia	133.283	1232	0	3.1606	3.1141	3.2071
Es sensible al arte y participa en la apreciación e interpretación de sus expresiones en distintos géneros que promuevan su formación integral/Nivel	87.744	1232	0	2.5572	2.5000	2.6144
Habilidades de investigación/Importancia	174.922	1232	0	3.4818	3.4427	3.5208
Habilidades de investigación/Nivel	132.079	1232	0	2.8800	2.8372	2.9227
Habilidades de gestión de la información (habilidad para buscar y analizar información proveniente de fuentes diversas)/Importancia	228.766	1232	0	3.6391	3.6079	3.6703
Habilidades de gestión de la información (habilidad para buscar y analizar información proveniente de fuentes diversas)/Nivel	144.266	1232	0	2.9586	2.9184	2.9989
Capacidad crítica y autocrítica propositiva/Importancia	266.534	1232	0	3.6415	3.6147	3.6683
Capacidad crítica y autocrítica propositiva/Nivel	167.788	1232	0	3.1184	3.0819	3.1549

Capacidad para adaptarse a nuevas situaciones/Importancia	237.246	1232	0	3.6813	3.6508	3.7117
Capacidad para adaptarse a nuevas situaciones/Nivel	172.661	1232	0	3.2782	3.2409	3.3154
Capacidad para generar nuevas ideas (creatividad)/Importancia	229.906	1232	0	3.6423	3.6113	3.6734
Capacidad para generar nuevas ideas (creatividad)/Nivel	153.635	1232	0	3.1168	3.0770	3.1566
Resolución de problemas/Importancia	277.287	1232	0	3.6813	3.6552	3.7073
Resolución de problemas/Nivel	156.513	1232	0	3.0762	3.0377	3.1148
Toma de decisiones/Importancia	246.543	1232	0	3.7210	3.6914	3.7506
Toma de decisiones/Nivel	122.472	1232	0	3.0373	2.9887	3.0860
Trabajo en equipo/Importancia	258.105	1232	0	3.6010	3.5736	3.6283
Trabajo en equipo/Nivel	162.332	1232	0	3.2028	3.1640	3.2415

* *Importancia* se refiere a la percepción que tiene el alumno de la competencia o habilidad para el ejercicio de tu profesión y *Nivel* se refiere a la percepción que tiene el alumno de la habilidad o competencia que ha desarrollado durante sus estudios en la universidad.

Fuente: Elaboración propia

Preference of the students with respect to the 28 generic training competences

Regarding the third part of the questionnaire, linked to the election and ordering of the five competences that are considered most important according to the student's opinion, the results are the following: "Leadership" (196 students), "Problem solving" (196) students), "Ability to generate new ideas (creativity)" (200 students), "Decision making" (150 students) and "Ability to communicate with non-experts in the field" (100 students) (see table 8).

Tabla 8. Prioridad de las cinco competencias principales

Importancia	**Competencia**	**Núm. de alumnos**
1	Liderazgo	196
2	Resolución de problemas	196
3	Capacidad para generar nuevas ideas (creatividad)	200
4	Toma de decisiones	150
5	Capacidad para comunicarse con personas no expertas en la materia	100

Fuente: Elaboración propia

Once again, the existence of differences between the responses of the participants was verified by comparing means through the t-Student statistical for independent samples with a confidence interval of 95% (table 9).

Tabla 9. Prueba de muestra única*

Importancia	Valor de prueba = 0					
	T	gl	Sig. (bilateral)	Diferencia de medias	95% de intervalo de confianza de la diferencia	
					Inferior	Superior
Liderazgo	70.311	1183	.000	12.17314	11.8335	12.5128
Resolución de problemas	55.768	1183	.000	10.25338	9.8927	10.6141
Capacidad para generar nuevas ideas (creatividad)	91.705	1183	.000	14.12500	13.8228	14.4272
Toma de decisiones	52.308	1183	.000	13.73733	13.2221	14.2526
Capacidad para comunicarse con personas no expertas en la materia	64.080	1183	.000	13.67399	13.2553	14.0927

Fuente: Elaboración propia

Hierarchical order of the 17 competences that have been considered as the most important for the professional development of engineers

Regarding the fourth part of the questionnaire, referring to the hierarchical order of the 17 competences that have been considered as the most important for the professional development of engineers, the results are shown in table 10.

Tabla 10. Orden jerárquico de las 17 competencias principales

Prioridad	Competencia	Núm. de alumnos
1	Habilidades de investigaciones	495
2	Habilidades interpersonales	298
3	Conocimientos generales básicos en el área de estudio	297
4	Capacidad de aplicar los conocimientos en la práctica	296
5	Capacidad de trabajar en un equipo interdisciplinar	248
6	Iniciativa y espíritu emprendedor	247
7	Capacidad de análisis y síntesis	245
8	Capacidad de aprender	199
9	Capacidad para generar nuevas ideas (creatividad)	198
10	Conocimientos de una segunda lengua	198
11	Conocimientos básicos de la profesión	197
12	Toma de decisiones	197
13	Capacidad crítica y autocrítica	196
14	Compromiso ético	150
15	Comunicación oral y escrita de la propia lengua	148
16	Apreciación de la diversidad y multiculturalidad	100
17	Capacidad para adaptarse a nuevas situaciones	50

Fuente: Elaboración propia

Here we also carried out the comparison of means through the t-Student statistical for independent samples with a confidence interval of 95% and the resulting data are shown in table 11.

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Tabla 11. Prueba de muestra única

Habilidad/Competencia	Valor de prueba = 0					
	T	gl	Sig. (bilateral)	Diferencia de medias	95 % de intervalo de confianza de la diferencia	
					Inferior	Superior
Capacidad de trabajar en un equipo interdisciplinar	55.593	1183	0	7.2931	7.0357	7.5505
Apreciación de la diversidad y multiculturalidad	85.875	1183	0	12.6453	12.3564	12.9342
Conocimientos generales básicos en el área de estudio	48.852	1183	0	6.3547	6.0995	6.6099
Conocimientos básicos de la profesión	48.071	1183	0	6.1613	5.9098	6.4128
Capacidad de análisis y síntesis	75.743	1183	0	9.7576	9.5049	10.0104
Capacidad de aplicar los conocimientos en la práctica	45.837	1183	0	5.6951	5.4513	5.9389
Capacidad para generar nuevas ideas (creatividad)	50.785	1183	0	5.3767	5.1690	5.5844
Capacidad para adaptarse a nuevas situaciones	76.648	1183	0	8.0743	7.8676	8.2810
Capacidad de aprender	62.306	1183	0	8.0845	7.8299	8.3390
Capacidad crítica y autocrítica	89.045	1183	0	10.7931	10.5553	11.0309
Toma de decisiones	55.697	1183	0	6.9569	6.7119	7.2020
Iniciativa y espíritu emprendedor	80.269	1183	0	10.7162	10.4543	10.9781
Compromiso ético	72.178	1183	0	10.1292	9.8539	10.4046
Habilidades interpersonales	111.844	1183	0	11.9671	11.7571	12.1770
Conocimientos de una segunda lengua	107.524	1183	0	11.4046	11.1965	11.6127
Comunicación oral y escrita de la propia lengua	122.784	1183	0	12.4654	12.2662	12.6646
Habilidades para la investigación	64.434	1183	0	9.2078	8.9274	9.4881
Habilidades interpersonales/Importancia	243.606	1232	0	3.3998	3.3725	3.4272
Habilidades interpersonales/Nivel	155.325	1232	0	2.7997	2.7643	2.8350
Liderazgo/Importancia	189.656	1232	0	3.4404	3.4048	3.4760
Liderazgo/Nivel	109.489	1232	0	2.9157	2.8634	2.9679
Capacidad de trabajar en un equipo interdisciplinar/Importancia	237.246	1232	0	3.6813	3.6508	3.7117
Capacidad de trabajar en un equipo interdisciplinar/Nivel	131.577	1232	0	2.9968	2.9521	3.0414
Capacidad para comunicarse con personas no expertas en la materia/Importancia	212.974	1232	0	3.4809	3.4489	3.5130

Capacidad para comunicarse con personas no expertas en la materia/Nivel	123.632	1232	0	2.9976	2.9500	3.0451
Apreciación de la diversidad y multiculturalidad/Importancia	218.226	1232	0	3.5588	3.5268	3.5908
Apreciación de la diversidad y multiculturalidad/Nivel	126.886	1232	0	2.7567	2.7141	2.7993
Habilidad para trabajar en un contexto internacional/Importancia	223.684	1232	0	3.6010	3.5694	3.6326
Habilidad para trabajar en un contexto internacional/Nivel	107.856	1232	0	2.4777	2.4326	2.5228
Conocimiento de culturas y costumbres de otros países/Importancia	164.168	1232	0	3.1582	3.1204	3.1959
Conocimiento de culturas y costumbres de otros países/Nivel	106.347	1232	0	2.4363	2.3914	2.4813
Habilidad para trabajar de forma autónoma/Importancia	237.246	1232	0	3.6813	3.6508	3.7117
Habilidad para trabajar de forma autónoma/Nivel	123.780	1232	0	2.8759	2.8303	2.9215
Diseño y gestión de proyectos/Importancia	258.105	1232	0	3.6010	3.5736	3.6283
Diseño y gestión de proyectos/Nivel	145.203	1232	0	3.0779	3.0363	3.1194
Iniciativa y espíritu emprendedor/Importancia	218.226	1232	0	3.5588	3.5268	3.5908
Iniciativa y espíritu emprendedor/Nivel	125.051	1232	0	3.1955	3.1453	3.2456
Compromiso ético/Importancia	308.982	1232	0	3.7599	3.7361	3.7838
Compromiso ético/Nivel	189.234	1232	0	3.4388	3.4031	3.4744
Preocupación por la calidad/Importancia	308.560	1232	0	3.7591	3.7352	3.7830
Preocupación por la calidad/Nivel	131.388	1232	0	3.2758	3.2268	3.3247
Motivación de logro/Importancia	333.796	1232	0	3.8005	3.7781	3.8228
Motivación de logro/Nivel	158.788	1232	0	3.3585	3.3170	3.4000

* *Importancia* se refiere a la percepción que tiene el alumno de la competencia o habilidad para el ejercicio de tu profesión y *Nivel* se refiere a la percepción que tiene el alumno de la habilidad o competencia que ha desarrollado durante sus estudios en la universidad.

Fuente: Elaboración propia

Results and Discussion

Based on the analysis carried out in the research, it was determined that 90% of students predominantly adopt the deep approach, that is, when understanding the contents and works proposed in class, they do not skimp on efforts and use strategies that allow them to relate the new content with the previous contents and check the relationship between the courses and their academic progress.

Regarding the predominantly superficial approach, it is only adopted by 6% of the students. This is: a very low percentage of the participating sample is interested in approving the subjects without intending to understand the practice and the contents, carrying out a minimum effort, which is why they mainly use memorization and automatic reproduction as learning strategies , taking into account only the contents and materials provided by the teacher in the class sessions.

On the other hand, the existence of 4% of students whose learning approach is not defined stands out. According to the results, this group of students has a deeper than superficial motivation, while using superficial and deep strategies in an indistinct manner. It is a group of students that seeks to understand the contents of the subjects studied, but only through the material delivered by the teacher in classes. Therefore, it is not interested in expanding the material on its own initiative (García, 2004). Several coincidences are determined between the characteristics manifested by this group of students with the approach known as comprehension and memorization, considering that the approaches adopted by the students are in a continuous change that depends on school progress (Hernández, García, Martínez, Hervás and Maquilón, 2002).

The research process shows significant differences with respect to the learning approach adopted by the students of the Engineering Division of the Guanajuato Campus of the University of Guanajuato. However, it agrees that the highest averages are in a deep focus.

Regarding the correlation of the subscales implicit in the learning approaches, it can be inferred that, in the global sample, the deep motives were significantly correlated with the deep strategies, not with the superficial strategies. Also, superficial motives correlated with surface strategies.

With regard to generic competences, the instrument used consisted of four parts, which are explained with precision in the corresponding section. Each one of them presented a different format in terms of answering questions, so the analysis was made based on it and therefore the suggested order. Here is a recapitulation of the results obtained.

Regarding the first question, "Do you think that the training you are receiving at the University is adequate?", 68.10% of the students surveyed feel that they are receiving a "Partial" university education and 31.90% mention receiving a "Complete" training. . Therefore, it is necessary to carry out an action plan to make the students know in a broad manner what type of training they are receiving as university students, as well as where and how to put this training into practice.

Regarding the second question. "How do you assess the possible career opportunities of your career?", 52.10% of the students considered that they have "Partially" professional outlets, 44% coincide in "Completely" and 4% chose the option "Almost nothing". Therefore, and according to the analytical results, more than 50% of the respondents consider that they know some options of the professional activities of their career. Consequently, a strategic plan is required in coordination with the employers of the graduates of the educational programs of the Engineering Division of the Guanajuato Campus so that the students know the professional activities and their areas of opportunity, proposing among several strategies the practices that can perform in the respective productive sector.

Now, from the second part of the questionnaire, referred to the presentation of 28 competences and their respective quantification from 1 to 4 depending on the importance given to each of them and the level of development acquired, it is inferred that in the first situation the competences that present the highest means and, therefore, the best quantified ones are "Motivation of achievement" (□□ = 3.80), "Ethical commitment" (□□ = 3.76), "Concern for quality" (□□ = 3.76), "Maintains a respectful attitude towards interculturality and the diversity of beliefs, values, ideas and social practices to promote spaces of academic and professional coexistence" (□□ = 3.72) and "Decision making (χ = 3.72).

In the second context, referring to the level of development acquired, the competencies with the highest averages are "Ethical Commitment" (□□ = 3.44), "Motivation of achievement" (□□ = 3.36), "Capacity to adapt to new situations "(□□ = 3.28)," Concern for quality "(□□ = 3.27) and" Plan your educational and life project autonomously under the principles of freedom, respect, social responsibility and justice to contribute as an agent of change to the development of their environment "(□□ = 3.24). It should be noted that "Ethical Commitment" and "Motivation of achievement" are among the five preferred in both cases.

From the third part of the questionnaire, referring to the five priorities related to the 28 generic competences presented, it should be noted that the competence "Ability to generate new ideas (creativity)" has a frequency of 16.66%, followed by the "Leadership" competences and "Problem solving" with a frequency of 16.33% and "Decision making" with 12.50%; Finally, the competition "Ability to communicate with non-experts in the field" is located, with a frequency of 8.33%.

Related to the fourth part of the questionnaire, concerning the categorization of 17 competences selected by the students, the order of priorities is as follows:

1. "Research Skills" with 495 preferences.
2. "Interpersonal skills" with 298 preferences.
3. "Basic general knowledge in the study area" with 297 preferences.
4. "Ability to apply knowledge in practice" with 296 preferences.
5. "Ability to work in an interdisciplinary team" with 248 preferences.
6. "Initiative and Entrepreneurship" with 247 preferences.
7. "Analysis and synthesis capacity" with 245 preferences.
8. "Ability to learn" with 199 preferences.
9. "Ability to generate new ideas (creativity)" with 198 preferences.
10. "Knowledge of a second language" with 198 preferences.
11. "Basic knowledge of the profession" with 197 preferences.
12. "Decision making" with 197 preferences.
13. "Critical and self-critical capacity" with 196 preferences.
14. "Ethical commitment" with 150 preferences.
15. "Oral and written communication of the own language" with 148 preferences.

16. "Appreciation of diversity and multiculturalism" with 100 preferences.
17. "Ability to adapt to new situations" with 50 preferences.

Regarding academic performance, 15.41% of engineering students have a "Regular and bad" academic performance (grades between 5.0 and 7.5) and 84.49% have a "Very good and good" performance (grades that range from 7.6 y 10.0).[3]

In relation to the determination of the correlations between the learning approaches, the generic competences and the academic performance of the students, it can be inferred that the academic performance correlates positively with the learning approaches, with the "Importance" and the "Level" of generic competences. Learning approaches correlate positively with academic performance, with the "Importance" and "Level" of generic competences.

The "Importance" of generic competences correlates positively with academic performance, learning approaches and the "Level" of generic competences. The "Level" of generic competences correlates positively with academic performance, with the "Importance" of them and with learning approaches. Therefore, there is a positive correlation between learning approaches, generic competences and academic performance.

Final thoughts

In the present project the instruments used (questionnaire, interview and observation) were appropriate for the measurement of learning approaches, since they were validated by a control sample. The results obtained reflect an adequate structure of the instruments because the subscales were grouped appropriately in the different approaches. On the other hand, Cronbach's alpha values obtained in the three main scales are between 0.490 and 0.820, which indicates high levels of internal consistency. In reference to the subscales, it is also observed that the results are very similar to those of the same instrument.

In relation to the second objective, it is obtained that the preferred approach by the students is the deep one. The fact that 90% of the sample has adopted the in-depth approach indicates an encouraging aspect in terms of greater motivation and use of higher-level strategies; that is, a higher quality learning process, which is desirable in the university context.

[3] Datos proporcionados por la Dirección de Asuntos Académico del Campus Guanajuato de la UG (junio 2016).

To determine the effect of the results of this research on teaching practice, two main stages can be distinguished in the analysis of the implementation of the Educational Model: an a priori and a posteriori. The a priori effect of the Educational Model, that is, before understanding it, accepting it and deciding to apply it in teaching practice, can not be considered totally insignificant, especially taking into account that the process of assimilation by a teacher or a unit (department) consumes time, energy and resources. It should be noted that it refers to the common case of the teacher with a certain academic profile in any area (such as, for example, a surveyor and hydraulic engineer with a specialization in geomatics, as well as a pedagogical base that he has acquired through experience, courses, etc.).).

Regarding the times required to assimilate the Educational Model, it might be worth asking: How much time does it take for a teacher to be trained to start up the Educational Model by competencies in his courses? Another interesting question is about calendar time. The effective time invested, for example, could be about 3 courses of 20 hours, although spaced over 3 to 5 years of the university school calendar. As a result of this time dedicated to the process of assimilation, there is a small adverse effect, since this is subtracted from class times. In addition, in the learning curve, students and classes that are experimental laboratory, according to statistical laws, will have a few or poor results.

In terms of material resources, these are variable, since they depend on places, trainers and quotas. Fortunately, the UG has its own Department of Educational Innovation, so resources that deviate from the teacher's budget for teacher training are significantly reduced, as well as travel times to other places.

Now, what can be said of the Educational Model on the teaching practice a posteriori? A first step is for the university professor to be convinced of the relevance of the Educational Model. By principle, the Educational Model offers a security of action on the teaching and on the impact this may have on the training of students, since there is a rigorous coherence in it, the product of a thorough study. Another implication of the Educational Model is a space of common understanding, in which the different actors of the system understand and act on the same "teaching language". It is clear that a space of understanding and a teaching language, coupled with the transcendental purpose pursued, creates an identity as postulated by the Educational Model.

Likewise, the characteristics of the Educational Model are also a starting point and a guide for the exercise of teaching creativity.

Therefore, knowing better the Educational Model of the UG allows to recognize the aspects that educational training has and can improve to renew teaching in its different aspects and, therefore, to innovate in teaching practice (UG, 2011). Innovation in teaching practice implies not only giving credit to every activity that takes place, but also stimulating the student to search for new information and investigate beyond what is seen in class on the topics addressed or dealt with.

Being able to have a tool that allows students to develop their search and creativity will allow a better understanding of the phenomena, as well as the techniques that can be used to facilitate not only learning, but also the practice of knowledge . And with this, be certain that in their professional lives they will be the best trained, since the intellect, when this is encouraged, comes to offer unimaginable achievements in the course of the university, as well as great value and great satisfaction as professionals.

Conclusions

Due to the aforementioned, the Educational Model of the UG is a reference that allows to frame the teaching practice. So that, well applied, it will have the virtue of guaranteeing the coherence of the formative activities on the part of the students, as well as of the teaching and administrative practice of this educational institution. Likewise, the Educational Model creates a space and a common understanding language where the different actors of the university system can participate and interact more effectively. It is evident that spaces and common language promote the development of an identity, as well as a beneficial influence towards the achievement of goals and the pursuit of ideals. However, due to its intrinsic characteristics, the Educational Model can be considered as an instrument for the creative development of university work, both inside and outside (its social environment).

Likewise, it is pertinent to mention that, despite the obstacles that may arise, the Educational Model offers the alternative for the UG to consolidate. And it can be even key on the road to a university with better foundations and able to face the challenges of the 21st century.

Finally, it is essential to point out that in the present investigation the following final conclusions were reached:

1) There is a clear coherence between the motives and the strategies belonging to the same learning approach. Also, a greater consistency is observed in the deep focus scale.

2) Some university students of engineering with deep motivation could make use of superficial strategies if the demands of the institution so require it.

3) Engineering students with superficial motivation could use deep strategies with the help of the teacher.

4) It is necessary to highlight the importance of designing, applying and evaluating intervention programs, both for students and for teachers, capable of modifying, in each case, the teaching-learning approaches, since they are the main protagonists of the educational action.

Finally, it is worth mentioning that, with this research, we are contributing to one of the main objectives that have been established within the Educational Model of the UG: The quality of both teaching and learning in the context of all and each one of the divisions and campus of the University of Guanajuato.

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