

# Desempeño de egresados de tecnologías de información en el examen general de egreso

*Performance of graduates in information technology in the general exit exam*

*Tecnologia da informação desempenho graduados no exame saída geral*

**Ricardo Armando Barrera Cámara**

Universidad Autónoma del Carmen, México

[rbarrera@pampano.unacar.mx](mailto:rbarrera@pampano.unacar.mx)

**Ana Alberta Canepa Sáenz**

Universidad Autónoma del Carmen, México

[acanepa@pampano.unacar.mx](mailto:acanepa@pampano.unacar.mx)

**Judith del Carmen Santiago Pérez**

Universidad Autónoma del Carmen, México

[jsantiago@pampano.unacar.mx](mailto:jsantiago@pampano.unacar.mx)

## Resumen

A nivel nacional existen instrumentos que evalúan los conocimientos y habilidades de los egresados de programas educativos de licenciatura. El examen general de egreso de licenciatura (EGEL), permite evaluar los conocimientos y habilidades de los egresados en base a pruebas nacionales establecidas por el Centro Nacional de Evaluación para la Educación Superior (CENEVAL). En este trabajo se analizaron los resultados obtenidos en las pruebas EGEL-ICOMPU, EGEL-ISOFT, EGEL-INFO e Informes Nacionales de los años 2011 a 2015. Estas pruebas corresponden a los programas educativos que imparte la Facultad de Ciencias de la Información: ingeniería en computación, ingeniería en sistemas computacionales y licenciatura en informática. Con la información obtenida y procesada se plantearon alternativas que coadyuven en la mejora de los resultados que se obtienen en las pruebas.

**Palabras clave:** EGEL, ingeniería en computación, ingeniería en sistemas computacionales, licenciatura en informática.

## Abstract

At the national level there are instruments that assess the knowledge and skills of graduates of Bachelor's degree programs. The general degree (EGEL by its name in Spanish) exit exam, allows to evaluate the knowledge and skills of graduates based on national tests established by the National Center for Assessment in Higher Education (CENEVAL by its name in Spanish). This paper analysed the results obtained in the tests EGEL-ICOMPU, EGEL-ISOFTE, EGEL-INFO and National Reports of the years 2011 to 2015. These tests correspond to educational programs taught by the Faculty of information sciences: computer engineering, computer systems engineering and Bachelor's degree in computer science. With the information obtained and processed alternatives were raised that contribute in the improvement of the results obtained in the tests.

**Key Words:** EGEL, computer engineering, computer systems engineering and Bachelor's degree in computer science.

## Resumo

Nacionalmente há instrumentos que avaliam o conhecimento e as habilidades dos graduados de programas de graduação de ensino. O Exame grau Exit geral (EGEL) avalia os conhecimentos e competências dos diplomados com base em testes nacionais criados pelo Centro Nacional de Avaliação do Ensino Superior (CENEVAL). Engenharia: Este artigo apresenta os resultados obtidos no EGEL-ICOMPU, EGEL-ISOFTE, EGEL-INFO e Relatórios Nacionais para os anos de 2011 a 2015. Estes testes são testes para programas educacionais oferecidos pela Faculdade de Ciências da Informação analisados computador, diploma de engenharia de computador no computador e sistemas. Com as alternativas de informação obtida e processada que ajudam a melhorar os resultados obtidos nos ensaios que foram levantadas.

**Palavras-chave:** EGEL, engenharia da computação, engenharia de sistemas informáticos, de graduação em ciência da computação.

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## Introduction

The National Center for Assessment in Higher Education (CENEVAL), has as main activity the design and implementation of instruments of evaluation of knowledge, skills and competencies, as well as the analysis and dissemination of findings that the tests show. The information provided is related to the knowledge and skills they acquire people of different educational programs at different levels. Professional organizations of various institutions make up collegiate bodies which participate in the development of its assessment tools.

Support programs such as Institutional Strengthening Integral Program (PIFI by its name in Spanish), Strengthening of the Quality in Educational Institutions Program (PROFOCIE by its name in Spanish), Strengthening the Quality Education Program (PFCE by its name in Spanish), or even state programs, consider addressing needs related to the improvement of the EGEL results. Eventually, the results have become an indicator for access to resources or as part of the quality of an institution. Therefore, the majority of public universities in Mexico presented as graduation requirement sustain EGEL test, and as a stimulus to the graduate professional degree according to the performance obtained in a particular test.

The Faculty of Information Sciences offer various educational degree programs, including: computer engineering, computer systems engineering and Bachelor's degree in computer science. These programs, respectively correspond the test EGEL-ICOMPU, EGEL-ISOFT and EGEL-INFO.

In recent years, the results of the tests have not presented the testimony of performance expected (an improvement on the outstanding accounts and sufficient, or decrease in not yet sufficient evidence). On the other hand, there is no evidence of an analysis or study at the institution on the performance and testimony obtained by the candidates in tests and profiles listed in the area of information technology in the institution.

Results from the EGEL represent one of the indicators of quality, considered in Industrial Chemical Engineering and Industrial Logistics Engineering programs. This study (Cruz, Pren, and Pinto, 2015) concludes that there is no relationship between evaluation and accreditation processes with indicators of educational backwardness or terminal efficiency, which impacts the qualification of teaching quality. The EGEL is seen as an indicator of quality in educational

programs by achieving Outstanding Performance Testimonials in educational programs such as Software Engineering (Vera y Mendoza, 2016).

Raúl A. Aguilar Vera and Julio C. Díaz Mendoza (2015) present an overview of the evolution and performance of students entering, leaving, passing, deserting and titling in the educational program of the Licenciatura in Software Engineering belonging The Autonomous University of Yucatan. The study considers the EXANI-II and EGEL-ISOFTE tests; We present a study with the information of the students of the career in Software Engineering, who did the EGEL test from 2008 to 2015, considering the results by performance in each area, the total of testimonies and their comparison with the national average reported by The CENEVAL. The fuzzy logic is treated with the intention of predicting the results of the test in graduates of the program of engineering in computer science as means of titulación. For this, a model is proposed that considers the results of the EGEL with the grades obtained in the units of learning and the evaluations of the teachers (Aguilar and Aguirre, 2015).

At the Autonomous University of Nayarit, the information obtained by the supporters of the undergraduate program in computer science in the test (EGEL-I) was collected and analyzed and some variables such as: sex, monthly income, parental schooling, institution of origin, Scholarship and employment status. The information corresponds to the period between 2008 and 2014 (Torre, Gallegos, and Fuentes, 2016). The variables with the highest correlation are: institution of origin and average. In the study (Elizabeth and Alonso, 2016) the individual and global results of students and graduates of the last cycles of the economic and social sciences division of the Caborca Campus of the University of Sonora were analyzed. The results indicate that the supporters do not have the knowledge expected in the test, since 91.83% obtained insufficient testimony.

An instrument (Cano, Valdez, Encinas, and Uruchurtu, 2014) was designed to measure the perception of graduates of the international trade bachelor's degree from the Hermosillo academic unit of the State University of Sonora. The results of the EGEL were compared with the results of the instrument applied to evaluate the implementation of the ENFACE educational model; The General Examination of Exams of the General Medicine Degree (EGEL-MG) and the National Examination of Aspirants to Medical Residences (ENARM) are two instruments

that measure the performance of the graduates of the Degree in General Medicine at the national level. Afterwards, the results obtained in the EGEL test of the graduates of the Licentiate in General Medicine of the Autonomous University of Ciudad Juárez are analyzed, comparing results of the EGEL-MG test and the ENARM as an indicator of competitiveness (Ávila et al., 2015 ).

An analysis of the EGEL results in chemistry is developed, considering the EGEL-Q content-based test and the EGEL-QUIM professional test (Hernández-Jiménez, Pavón-Silva, and Rodríguez-Barrientos, 2015). The results showed that the percentage of uninformed bearers increased significantly by 75.4% in the transition from one test model to another.

## **MATERIALS AND METHODS**

The general graduation exam is organized by areas, subareas and aspects. The areas are linked to the professional fields, the sub-areas comprise the main professional activities of each professional field and the aspects identify the knowledge and skills required to perform specific tasks of the profession. For this study the EGEL-ICOMPU (National Evaluation Center for Higher Education, 2016b) is considered for the educational program of Computer Engineering, EGEL-ISOFT (National Assessment Center for Higher Education, 2016c) for Systems Engineering Computacionales and EGEL-INFO (National Evaluation Center for Higher Education, 2016a) for the Degree in Informatics. Table 1 shows the areas, the total of reagents and the percentage value that corresponds to each area and by test established by CENEVAL.

**Table 1.** Areas, total reagents per area (TR), percentage of area testing for EGEL-ICOMPU, EGEL-ISOFT, EGEL-INFO.

EGEL-ICOMPU			EGEL-ISOFT			EGEL-INFO		
Área	TR	% Examen	Área	TR	% Examen	Área	TR	% Examen
A. Selección de sistemas computacionales para aplicaciones específicas	42	22.58	A. Análisis de sistemas de información	24	13.26	A. Detección de las necesidades informáticas de las organizaciones	33	16.92
B. Nuevas tecnologías para la implementación de sistemas de cómputo.	55	29.57	B. Desarrollo e implantación de aplicaciones computacionales	74	40.88	B. Gestión de proyectos tecnológicos	50	25.64
C. Desarrollo de hardware y su software asociado para aplicaciones específicas.	29	15.59	C. Gestión de proyectos de tecnologías de información	26	14.36	C. Gestión de la función informática	47	24.10
D. Adaptación de hardware y/o software para aplicaciones específicas	29	15.56	D. Implementación de redes, bases de datos, sistemas operativos y lenguaje de desarrollo	57	31.49	D. Diseño de soluciones de tecnologías de la información y comunicación	35	17.
E. Redes de cómputo para necesidades específicas	31	16.67				E. Implementación de tecnologías de la información y comunicación	30	15.38

**Source:** elaboración propia a partir de información de la guía para el sustentante de EGEL-ICOMPU, EGEL-ISOFT, EGEL-INFO.

A level of performance shows the level of dominance that a sustainer presents in relation to the knowledge and skills evaluated in the test. Achieving level two or three involves having the knowledge and skills established in the test. An assessment scale called the CENEVAL index is used, where the lowest score is 700 and the highest is 1300 points. A performance not yet satisfactory (ANS) corresponds to a score of 700 to 999, a Satisfactory performance (DS) corresponds to 1000 to 1149 and an Outstanding performance (DSS) corresponds to 1150 to 1300 points. The number of areas that each exam possesses varies in a range of 4 to 5, with percentages that vary in relation to the area and subareas.

A testimonial is obtained according to the criteria established for each examination, taking into account the minimum desirable performance (DS), in relation to the score obtained with a level of performance (Still Not Satisfactory, Satisfactory and outstanding) and the number of areas required To obtain a Sufficient Performance Testimony (TDS) or Outstanding Performance Testimony (TDSS). Table 2 shows the criteria for obtaining the testimony.

**Table 2.** Criteria for Obtaining EGEL Testimonials (Centro Nacional de Evaluación para la Educación Superior, 2016a, 2016b, 2016c)

<b>Prueba</b>	<b>Requisitos</b>	<b>Testimonio</b>
EGEL-ICOMPU	<ul style="list-style-type: none"> <li>Al menos cuatro de las cinco áreas con desempeño suficiente (DS) o Desempeño sobresaliente DSS).</li> </ul>	Testimonio de Desempeño Satisfactorio (TDS)
	<ul style="list-style-type: none"> <li>Al menos dos áreas con desempeño sobresaliente (DSS) y el resto con desempeño satisfactorio (DS).</li> <li>En las cinco áreas obtienen desempeño satisfactorio (DS) o alcanzan el nivel de desempeño sobresaliente (DSS)</li> </ul>	Testimonio de Desempeño Sobresaliente (TDSS)
EGEL-ISOFT	<ul style="list-style-type: none"> <li>Al menos tres de las cuatro áreas muestran desempeño suficiente (DS) o desempeño sobresaliente (DSS).</li> </ul>	Testimonio de Desempeño Satisfactorio (TDS)
	<ul style="list-style-type: none"> <li>Nivel de desempeño sobresaliente (DSS) en dos áreas y las otras dos con nivel de desempeño satisfactorio (DS).</li> <li>Nivel de desempeño satisfactorio (DS) o desempeño sobresaliente (DSS) en las cuatro.</li> </ul>	Testimonio de Desempeño Sobresaliente (TDSS)
EGEL-INFO	<ul style="list-style-type: none"> <li>Al menos en tres de las cinco áreas con nivel de desempeño satisfactorio (DS) o desempeño sobresaliente (DSS).</li> </ul>	Testimonio de Desempeño Satisfactorio (TDS)
	<ul style="list-style-type: none"> <li>Al menos dos áreas con el nivel de desempeño sobresaliente (DSS) y las restantes con desempeño satisfactorio (DS).</li> <li>Desempeño satisfactorio (DS), o desempeño sobresaliente (DSS) en dos de las cinco áreas que integran el examen, y el nivel de desempeño sobresaliente (DSS) en las restantes.</li> </ul>	Testimonio de Desempeño Sobresaliente (TDSS)

Source: elaboración propia basada en la guía para el sustentante de EGEL-ICOMPU, EGEL-ISOFT, EGEL-INFO.

As a source of data, the results of the General Exit Examination of the Degree provided by the faculty management corresponding to five years (from March 11, 2011 to December 4, 2015) of the educational programs in Computer Engineering , Computer Systems Engineering and Computer Science Degree. From these were obtained: date of application, score and performance by area, score and testimonial result. The records correspond to the results of 325 sustained tests of EGEL-ICOMPU, EGEL-ISOFT and EGEL-INFO. Another element considered is the bibliographic sources suggested in the EGEL guidelines (National Evaluation Center for Higher Education, 2016a, 2016b, 2016c). The EGEL annual reports published by CENEVAL on its EGEL-ICOMPU, EGEL-ISOFT and EGEL-INFO website from 2011 to 2015 were also considered. These reports do not include the key to the institution as EGEL headquarters For the above examinations.

With the data of the results a database with separated data of each test was designed and constructed, conformed of the fields (variables) identified. Also, with the data stored, it was analyzed using statistical and data mining tools.

## **RESULTS**

The results were analyzed considering the different testimonies obtained in each test, the performances in each area per test, as well as the bibliography suggested by each test and its availability in the institution.

### **Testimony**

The results obtained for the educational programs of Computer Engineering, Computer Systems Engineering and Computer Science degree show that 73.23% of the supporters obtained an Unsatisfactory Testimony, 23.08% Satisfactory and 3.69% Satisfactory (Table 3).



**Table 3.** Total and percentage of testimonies by profile of the year 2011 to 2015.

Prueba	Testimonio			Total
	Satisfactorio	Sin Testimonio	Sobresaliente	
EGEL-ICOMPU	18 (17.14 %)	81 (77.14 %)	6 (5.71 %)	105 (32.31 %)
EGEL-ISOFT	43 (28.86 %)	101 (67.79 %)	5 (3.36 %)	149 (45.85 %)
EGEL-INFO	14 (19.72 %)	56 (78.87 %)	1 (1.41 %)	71 (21.85 %)
Total	75 (23.08 %)	238 (73.23 %)	12 (3.69 %)	325

Source: elaboración propia a partir de los reportes individuales de la prueba EGEL-ICOMPU, EGEL-ISOFT, EGEL-INFO.

On the other hand, the national results show that 50.7% of the supporters did not obtain Testimony, 36.9% Satisfactory Testimony and 12.4% Outstanding Testimony (table 4). This information was obtained from the sum of the results of testimony of each year, obtained from the annual reports of EGEL.

**Table 4.** Results of National Reports from 2011 to 2015.

Perfil	Testimonio			Total
	Satisfactorio	Sin Testimonio	Sobresaliente	
EGEL-ICOMPU	5 886 (33.3 %)	9 968 (56.4 %)	1 820 (10.3 %)	16 674
EGEL-ISOFT	4 675 (38.1 %)	6 116 (49.8 %)	1 486 (12.1 %)	12 777
EGEL-INFO	6 614 (39.7 %)	7 551 (45.4 %)	2 484 (14.9 %)	16 649
Total	17 175 (36.9 %)	23 635 (50.7 %)	5 790 (12.4 %)	46 660

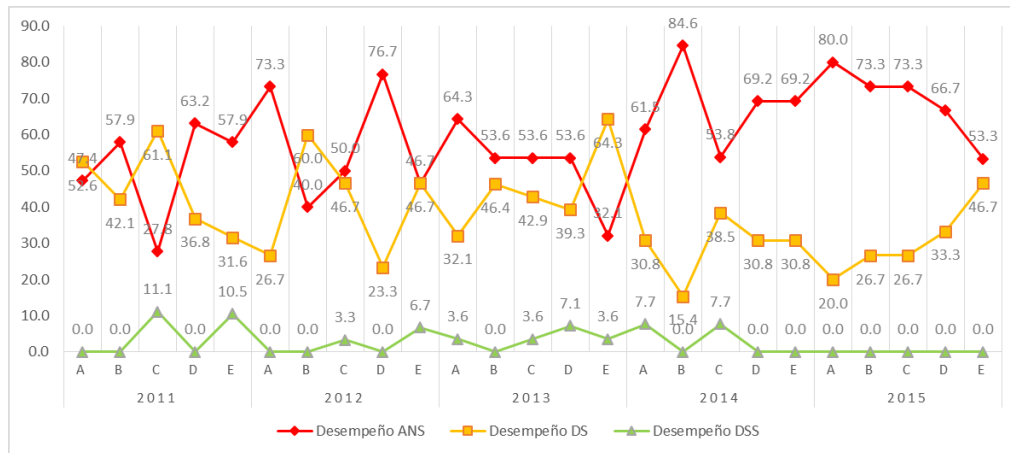
Source: elaboración propia a partir de los informes nacionales EGEL-ICOMPU, EGEL-ISOFT, EGEL-INFO del año 2011 al 2015.

### *Performance*

The data obtained were concentrated for the annual analysis according to the performance of each area and the profile of the exam. For this part of the study we considered the records that present all the information of the variables identified in the official results: the result in the performance score and the obtained testimony.

In the case of EGEL-ICOMPU, a total of 105 sustained tests were presented, of which none were excluded.

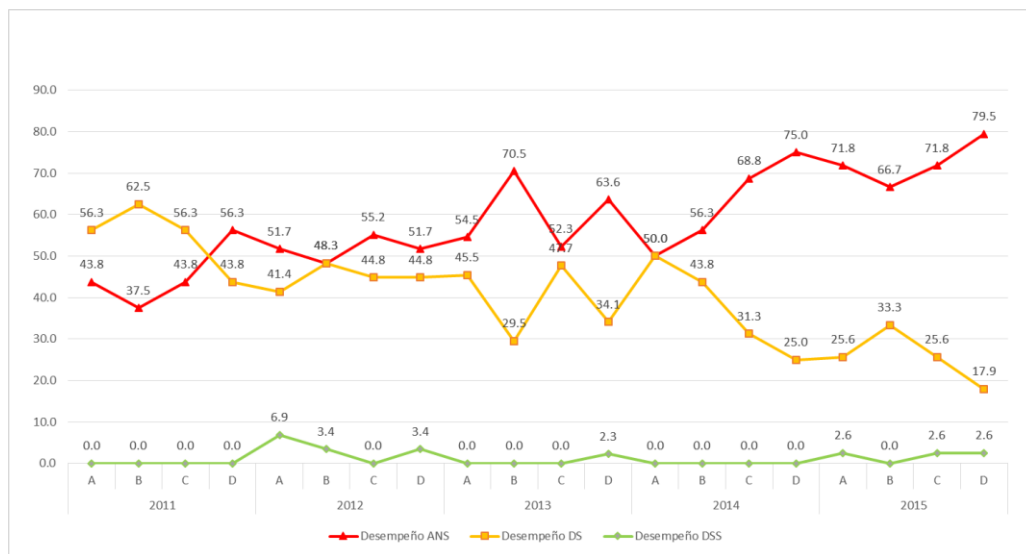
**Figure 1.** Percentage of performances by area and year of application for EGEL-ICOMPU del año 2011 al 2015



Source: elaboración propia a partir de los reportes individuales de la prueba EGEL-ICOMPU.

- In the case of EGEL-ISOFT, a total of 149 tests were presented, of which 144 present the results of performance and testimony, and 5 only provide the testimony obtained. That is, 5 results of 149 did not present the performance results of each area, so they were excluded from the analysis.

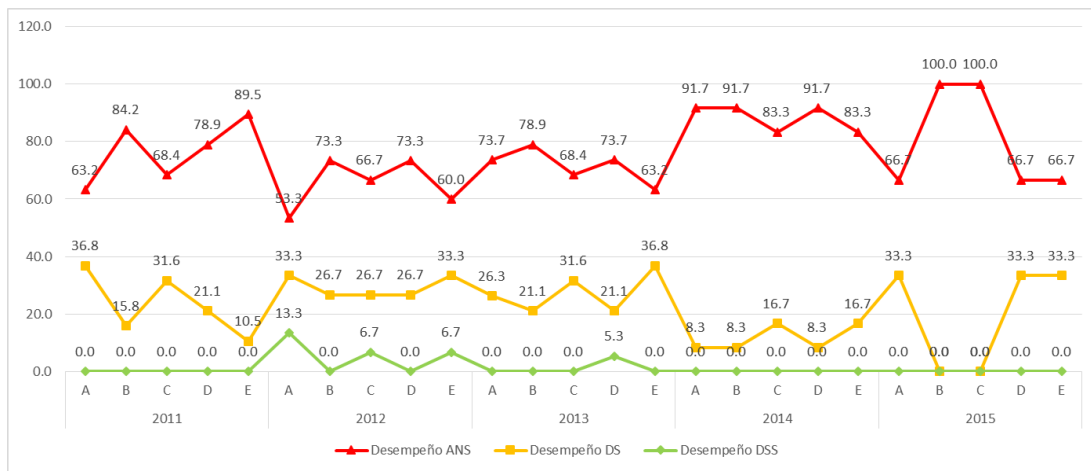
**Figure 2.** Percentage of performances by area and year of application for EGEL-ISOFT from 2011 to 2015.



Source: elaboración propia a partir de los reportes individuales de EGEL-ISOFT.

- In EGEL-INFO a total of 71 tests were presented, of which only 68 presented the results of performance with testimony and 3 only the testimony obtained. That is, 3 results of 71 did not present the performance results of each area, and were excluded from the analysis by area.

**Figure 3.** Percentage of performances by area and year of application for EGEL-INFO from year 2011 to 2015.



Source: elaboración propia a partir de los reportes individuales de EGEL-INFO.

**Bibliographic references**

The review of the bibliography suggested in the guidelines and the existence through the online consultation system of the institution show that for the EGEL-ICOMPU test, 11 (20.37%) sources are available from 54, in which 1 is a website; For EGEL-ISOFT of 9 (23.68%) sources of 38, in which 3 are websites, and EGEL-INFO of 8 (19.51%) sources of 41, of which 3 are websites.

**DISCUSSION**

Of the three educational programs, the one with the highest performance was related to the EGEL-ISOFT, since of a total of 149 sustained tests, 28.86% obtained a satisfactory testimony (Table 3).

When comparing the total number of testimonies not obtained from the faculty, 238 (73.23%) of a total of 325 were registered. The national results are not very encouraging because a high number of supporters: 23,635 (50.7%) did not obtain testimony. However, if we consider the total number of supporters at the national level who obtained sufficient and outstanding testimony: 22 965 (49.3%) and subtracted the number of support that did not obtain testimony, we obtain a range of difference of 670 (1.4%), Support.

The results of performance by area for Computer Engineering are as follows (figure 1): in 2011 the best performance was obtained in area C with 61.1% of sufficient performance and 11.1% of outstanding performance, area D with 63.2% Still not satisfactory. In 2012, the best performance was achieved in area B with 60.0% of sufficient performance, followed by area E with 46.7% of sufficient performance and 6.7% of outstanding performance, area A with 73.3% still not satisfactory. In the year 2013 the best performance was achieved in area E with 64.3% of sufficient performance and 3.6% of outstanding performance, area A with 64.3% still not satisfactory. In the year 2014, the best performance was obtained in area C with 38.5% of sufficient performance and 7.7% with outstanding performance, area B with 84.6% still not satisfactory. In the year 2015 the best performance was obtained in the area E with 46.7% of sufficient performance and the area A with 80.0% still not satisfactory.

The result of performance per area for Engineering in Computer Systems are as follows (figure 2): in 2011 the best performance was obtained in area B with 62.5% of sufficient performance and area D with 56.3% still not satisfactory. In 2012, the best performance was obtained in area B with 48.3% of sufficient performance and 3.41% of outstanding performance, area C with 55.2% still not satisfactory. In the year 2013 the best performance was obtained in area C with 47.7% of sufficient performance, area B with 70.5% still not satisfactory. In 2014, the best performance was obtained in area A with 50.0% of sufficient performance, area D with 75.0% still not satisfactory. In the year 2015 the best performance was obtained in area B with 33.3% of sufficient performance, area D with 79.5% still not satisfactory.

The result of performance by area for the Degree in Computer Science (figure 3) are: in 2011 the best performance was obtained in area A with 36.8% of sufficient performance and area E with 89.5% still not satisfactory. In 2012, the best performance was achieved in area A with 33.3% of sufficient performance and 13.3% of outstanding performance, and area B and D with 73.3% still

not satisfactory. In 2013 the best performance was achieved in area E with 36.8% of sufficient performance, and area B with 78.9% still not satisfactory. In 2014 the best performance in area C and E was obtained with 16.7% of sufficient performance, and the area A, B, D with 91.7% still not satisfactory. In 2015, the best performance was achieved in area A, D and E with 33.3% of sufficient performance, and area B and C with 100.0% still not satisfactory.

For the Computer Engineering (EGEL-ICOMPU) educational program - considering the median -, a better performance was presented in area E with 1001 points, in Area C with 992 points, in area B with 988 points, in Area A with 975 points and area D with 959 points. In terms of performance, area E is in the range of sufficient performance (DS). The maximum score was obtained in area E with 1235 points and the minimum value in area D with 722 points; For the educational program in Computer Systems Engineering (EGEL-ISOFT), considering the median presented a better performance in area A with 983.00 points, in Area B with 977, in area C with 974.50 and in area D with 958. However, these results are in the Insufficient Performance (INS) range. The maximum score was presented in area D with 1177 and the minimum in area C with 773 points; For the Bachelor's degree in Informatics (EGEL-INFO) program, considering the median was better performance in area A with 968 points, in area C with 952.50 points, in area D with 942 points, in Area B With 933 points and in area E with 926 points. The maximum score was obtained in area A with 1285 points and the minimum in area A with 782 points.

CENEVAL in the years 2011 and 2012 applied two test models that in the annual reports denominates: old structure and new structure. The new structure consists of updating the existing areas, subareas and themes, as well as the number of reactants and percentage for each area and sub-area. For 2012, CENEVAL applied the two structures for EGEL-ICOMPU (EGEL and Psychometric Assistant Directorate General, 2013b); In 2012 he applied the two structures for EGEL-ISOFT (General Directorate of EGEL and Psychometric, 2013c), and in 2011 and 2012, the two structures for EGEL-INFO (EGEL and Psychometric Assistant Directorate, 2012, 2013a)

The bibliography suggested in the guidelines does not follow a reference system or a homogeneous bibliographic query and presented ambiguous, duplicate or scarce bibliographic data. They do not present complete data such as: ISBN, author's name (s), edition or name of the publisher, which makes their search difficult or causes confusion. In the case of web sources,

some are incorrect or unavailable at the time of consultation. EGEL-ICOMPU has 20.37%, with 1 website, EGEL-ISOFT of 23.68% with 3 websites and EGEL-INFO 19.51% with 3 websites of suggested bibliography.

## **CONCLUSIONS**

The results obtained during five years within the educational programs that are taught in the faculty within the EGEL test (performances and testimonies), are very sensitive and not very motivating (73.23% do not obtain testimony). No favorable results have been obtained in the increase of the obtaining of Outstanding Testimonies or in the diminution of supporters Without Testimony.

The Computer Engineering career shows its best performance by area in 2011 in area C with 61.1% of sufficient performance and 11.1% of outstanding performance and the year 2013 in area E with 64.3% of sufficient performance and 3.6% of Outstanding performance; The Computer Systems Engineering career, shows its best performance by area in 2011 in Area B with Sufficient Performance of 62.5% and in 2014 in Area A with Sufficient Performance of 50.0%; In the Degree in Computer Science, a better performance is presented in 2012 with a sufficient performance of 33.3% and an outstanding performance of 13.3% in area A; In 2011 there is a sufficient performance of 36.8% in area A and in 2013 a sufficient performance of 36.8% in area E.

The national results over five years show that 50.7% of the supporters did not perform. This result, considered as an indicator, must be taken care of by the institutions and by the body that generates the test.

The bibliography suggested in the test guides is not available in the faculty or institutional library. In addition to this, there is a lack of homogeneity in the reference system.

Some of the strategies that can contribute to an improvement are: conducting workshops or seminars in the most deficient areas; Select groups of students and not a whole generation of supporters; Prepare students for elective subjects; Selection of supporters based on academic

trajectory; Voluntary choice of the supporters and updating of the physical or electronic bibliographic collection.

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