Asociación Colombiana de Facultades de Ingeniería

Revista Educación en Ingeniería
http://www.educacioneningenieria.org

Proposal of a learning tool for introduction to petroleum engineering subject and recommendations for modification of petroleum engineering curricula in Colombian universities

Fernando Antonio Plazas Niño & Henry Mauricio Galvis Silva

Escuela de Ingeniería de Petróleos, Universidad Industrial de Santander, Bucaramanga, Colombia.
faplazni@uis.edu.co, hemagasi@uis.edu.co

Abstract— A learning tool is proposed from the matrix of competences for graduating engineers presented by SPE Talent Council in order to provide a consistent instrument for teaching the subject of Introduction to Petroleum Engineering. In addition, this learning tool is used to analyze current curricula of petroleum engineering in the main Colombian universities and recommend some adjustments to improve the programs and enhance the professional skills and the expectations alignment of future engineers. A more condensed and visual perspective of the SPE Graduate Matrix is presented. In addition, new trends of knowledge sets such as soft skills, unconventional reservoirs, and data science are discussed. Based on the previous analyses, a comparative chart is built to assess the current content of petroleum engineering curricula in Colombian universities and several recommendations are proposed in order to achieve the required level in the professional profiles of future petroleum engineers and to guarantee the expectations alignment of these new professionals. In general terms, there is a prominent need for including courses on offshore technologies, field operations, data science and applied statistics and economics to strength the current curricula in Colombia.

Keywords— Learning, curriculum, competence, petroleum engineering.

Recibido: 19 de febrero de 2020. Revisado: 15 de abril de 2020. Aceptado: 25 de junio de 2020.

Propuesta de una herramienta de aprendizaje para la materia de introducción a la ingeniería de petróleos y recomendaciones para la modificación del plan de estudios de ingeniería de petróleos en universidades colombianas

Resumen— Una herramienta de aprendizaje es propuesta a partir de una matriz de competencias para ingenieros recién egresados que fue presentada por el consejo de talento de SPE, con el fin de proporcionar un instrumento consistente para la enseñanza de la asignatura de introducción a la ingeniería de petróleos. Además, esta herramienta es usada para analizar los planes de estudio actuales de ingeniería de petróleos en las principales universidades colombianas, y así mismo recomendar algunos ajustes para mejorar los programas y fortalecer las habilidades y la alineación de expectativas de los futuros ingenieros. Igualmente se presenta una versión más visual y condensada de la matriz de graduados de SPE. Adicionalmente, las nuevas tendencias de conocimientos tales como las habilidades blandas, los yacimientos no convencionales, y la ciencia de datos son discutidas. Con base en los previos análisis, un cuadro comparativo es construido para evaluar el contenido curricular de los planes de estudio de los programas de ingeniería de petróleos en universidades colombianas, y varias recomendaciones se proponen con el objetivo de lograr el nivel requerido en el perfil profesional de los futuros ingenieros de petróleos, y de esta manera garantizar la alineación de expectativas de estos nuevos profesionales. En términos generales, hay una prominente necesidad por incluir materias de operaciones costa fuera, operaciones de campo, ciencia de datos, estadística y economía aplicada, para fortalecer los planes de estudio en Colombia.

Palabras Clave— Aprendizaje, plan de estudios, competencia, ingeniería de petróleos.

1 Introduction

According to the BP Energy Outlook 2019, oil and gas will continue to have the major share –around 50%- in the energy mix by 2040 [1], and consequently the industry will require more petroleum engineers to meet the growth and demand for fossil fuels in the coming years [2].

Besides that, the new reality encompasses many challenges such as mature field management and enhanced oil recovery methods, offshore drilling and production optimization, unconventional hydrocarbons development [3], digital oilfield concept and applications of data science and artificial intelligence [4], among others. In this context, different defiances are emerging, and they demand capable professionals with a strong practical and theoretical knowledge for the near future.

In order to contribute to this imminent need for skilled engineers, the academy is always committed to providing high-quality education, nevertheless, it is critical to combine the requirements from the industry as well, given that the future professionals must be ready to face the tasks proposed by the companies in the world of work.

Taking into account the importance of adopting the vision of the industry into the educational approach, a thorough study is carried out to filter and map the main dimensions and competencies of the SPE Graduate Technical Knowledge Matrix considering that summarizes a research of the skills required by operator and services companies [5].

The data obtained from the first analysis is used to structure the outline of the learning tool focused on competencies and aimed at supporting the teaching of the introduction to petroleum engineering class, considering this class as the beginning of the career and instrument of expectations alignment for the students. Thereafter, a digital program based on VBA and MS Excel is developed for providing equations, theoretical bases and useful references corresponding to the overall compendium of competencies for a recent graduate in petroleum engineering.

This tool can be really useful since it reflects the competencies required by recent graduates according to an international standard and this becomes an instrument to upgrade the teaching of introduction to petroleum engineering

class and also other subjects strongly related to specific competencies.

Finally, a complete revision is performed to evaluate current curricula of petroleum engineering in the main Colombian universities, and several recommendations are made for improving the graduate profiles according to the content of the learning tool proposed and the new trends of the O&G industry which are also discussed.

2 The SPE Technical Knowledge for Graduating Engineers Matrix

As a product from a comprehensive study of academic curricula and expectations from industry of technical knowledge of recent graduates, a matrix of knowledge sets was constructed by SPE Talent Council. This matrix of knowledge sets was used to create a survey that was sent to a variety of companies (including international and national oil companies, as well as mid-size companies and companies in the service sector), and each company was asked to rank each knowledge set as follows:

- Required: Indispensable knowledge set for newly hired petroleum engineering graduates.
- Valued: The knowledge set that, while not required of new hires, it is none-the-less valued for employers
- Not required: The knowledge set not requested by industry with regard to newly hired petroleum engineering graduates

The long-term objective of the SPE Graduate Technical Knowledge Matrix is to serve as a reference tool for industry, academia and students [5]; this is the purpose quoted here since it is taken as the basis for creating the learning tool, where it is possible to reconfirm the importance of strong practical knowledge of field practices and operations, as well as a working knowledge of the foundations of petroleum engineering –drilling, production and reservoir engineering-, and also geoscience, economics and technical writing and presentation.

3 Rethinking the SPE Graduate Matrix- A more visual and condensed perspective

Within the review performed to the SPE Graduate Matrix, a first filter was considered in order to identify the most critical knowledge sets based on the following criteria: a) Required category score > 40%, b) Sum of required and valued category scores > 90%.

These criteria were defined in that way owing to it is taken account both the relevance of being a required knowledge set and the positive valuation of each knowledge set.

After considering this filter to select the most important knowledge sets, a classification was designed in order to organize and structure the different knowledge sets and to provide a better sense to the matrix, however, it does not pretend to be the better way to order the knowledge in petroleum engineering but to give easiness in the interpretation of the content of the graduate matrix. In this context, three levels are defined within this work:

1. Main dimensions
2. Knowledge cores
3. Competencies

The main dimensions were created based on the current content of the SPE Competency Management Tool [6], where well engineering, subsurface engineering and facilities and process engineering (equivalent to Production engineering and operations) are defined as the competency models for the job family of entry-level engineers. A fourth dimension is included to embark transversal knowledge sets which are used in tasks of the other dimensions such as basic engineering concepts, statistics, petroleum law and project management. The four main dimensions are summarized in figure 1.

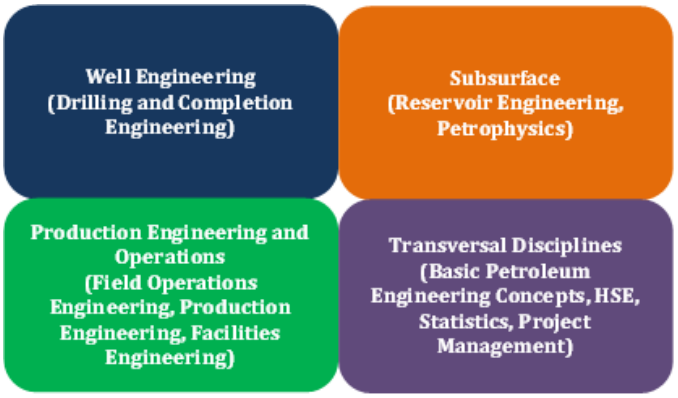

Figure 1. Main dimensions of petroleum engineering defined for the learning tool.
Source: The author

After defining the main dimensions, a refining of the knowledge sets was carried out to determine the knowledge cores, which are the most representative areas or significant topics of the four dimensions of petroleum engineering. These knowledge cores are strongly related to the curricular subjects taught in faculties and they are listed in figure 2.

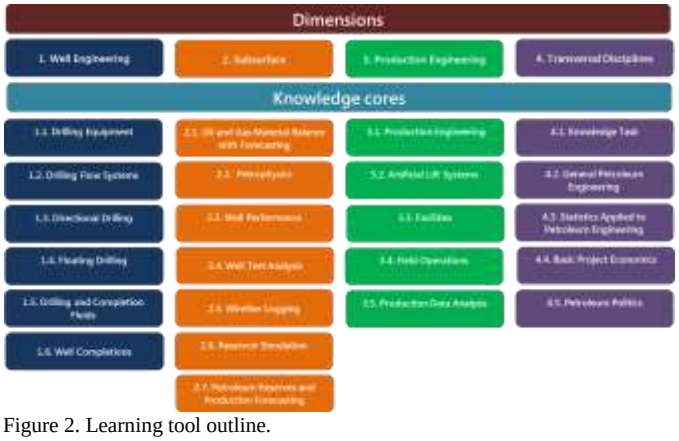

Figure 2. Learning tool outline.
Source: The author

In third place, each knowledge core was associated with two or more competencies which were reformulated to guarantee that competency statements were written in a manner to be measurable using descriptors such as identify, describe and calculate [7]. One example of the competencies for a

knowledge core is shown in figure 3.

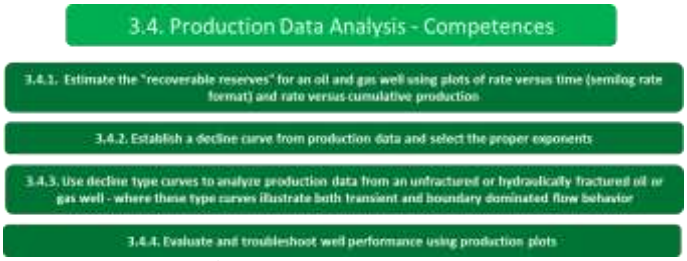

Figure 3. Competencies for knowledge core: Production Data Analysis
Source: The author

4 Design of the Learning Tool – Highlights

Using this new map of the SPE Graduate Matrix with a defined structure divided by main dimensions, knowledge cores and competencies highly demanded by O&G industry for recent graduates, a learning tool was designed to create relevant contents related to each competency such as definitions, images, diagrams, equations, references among others. The main tool features are depicted next.

The learning tool was built employing MS Excel® and the programming language Visual Basic for Applications of the same program due to the easiness to incorporate graphs and images, and also owing to the familiarity for recent graduates from high school. The entire tool was developed in English in order to give an initial lesson regarding the relevance of learning English as a second language for a petroleum engineer in Colombia, and to enable the socialization of the tool in other countries as well.

The file is divided by sheets according to the knowledge core and competencies in discussion; each dimension is linked to its corresponding knowledge cores and in turn each knowledge core is linked to each one of its competencies. On the upper right part of each sheet, there are two buttons, one menu button which is used to return to the start in order to proceed to another route, and a button of "Export PDF" which is used to extract a pdf file with the information of the sheet in case it is required; figure 4 illustrates the interface of a typical sheet.

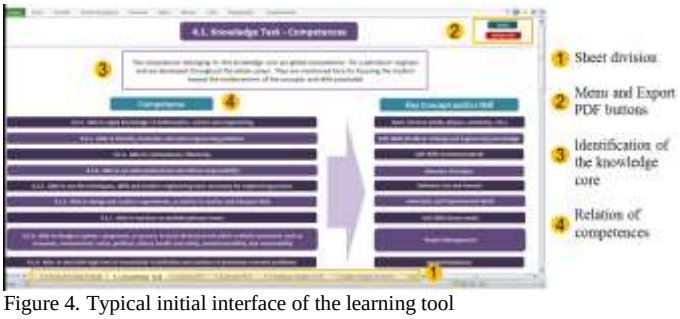

Figure 4. Typical initial interface of the learning tool
Source: The author

The competencies, knowledge cores and dimensions are numbered for better tracking in the file and an index is available in the last sheet for providing a better way of searching for a specific topic or word. On the other hand, the first sheet contents the instructions to clarify the manner of navigating through the file, and there is a special sheet with a checklist aimed to mark one to one each competency covered or fulfilled, this is good control to have a complete view of the advancement in the career.

Depending on the competency, six resources are addressed: definitions, equations, images, diagrams or graphs, tables and videos, and each resource are properly numbered and referenced within the file, as it is noticed in figure 5. In addition, books and/or papers are recommended to take a deeper look to the topic, and the most important software programs are listed as applicable. In this context, the content was developed for freshmen students starting their careers in petroleum engineering and thus the substance is not advanced and the concepts are not explored thoroughly however, the complete compendium of references are provided at last and a virtual petroleum engineering toolbox is recommended for students and professionals interested in more complex calculations and specific cases [8].

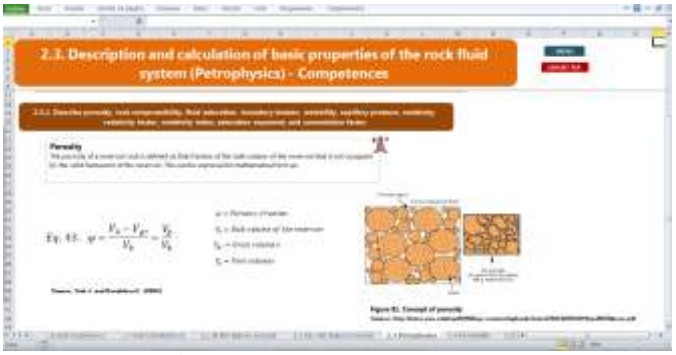

Figure 5. Example of resources used in the learning tool.
Source: The author

5 Relevance of Introduction to Petroleum Engineering subject and the role of the learning tool

The class of introduction to petroleum engineering should work as an alignment of expectations for young students in order to show a wide but simple vision of what petroleum engineering is and which are the necessary competencies to be developed during the career. This subject has a critical role since it should set the route guide for following throughout the whole studies, however nowadays there is no such sense of importance focused on the subject, and students are not aware of the importance of gaining specific skill sets for facing the labor market from the first instant that the career starts.

The learning tool discussed in this work aims to contribute to the alignment of expectations of future petroleum engineers and provide a trustful source of consulting and standardizing for teachers in order to orientate the class of introduction to petroleum engineering towards a strong description of the labor of a petroleum engineer and the emphasis on developing relevant competencies during the career based on an international survey.

Additionally, a project-based approach is suggested to teach the class of introduction to petroleum engineering where critical competencies may be focused on the solution of study cases (which could be supplied by professors in advanced subjects); this teaching method has proved goods results

because it provides more opportunities for students to be exposed to the different engineering processes and concepts, connect the different important engineering skills such as teamwork and communication to engineering coursework, and gain an understanding of engineering problems and the different ways in which they can be solved [9].

Another important application for this tool is to provide a quick reference of information for unemployed recent graduates, given that the rate of unemployment is significantly high in Colombia, where it can take months and even years to get a job opportunity and many times it is critical to refresh engineering concepts.

Next step would be to integrate the information contented into the learning tool to a virtual platform in order to convert the structure to an e-learning tool adding interactive components such as quizzes, videos, motion diagrams and so on, so that it is possible to enhance the learning experience becoming more engaging and effective [10].

Being this tool a good effort to gather and describe the prime competencies and knowledge cores demanded from recent graduates, there is a need to complement the based-competency formation after graduation, with a strict base in terms of competency units and job descriptions, and therefore it is recommended the SPE competency tool management, a user-friendly platform which offers the control of personal development for SPE members using a methodology of self-assessment, identification of skill gaps and the design and follow-up of a learning plan to close those gaps [11].

6 New Trends and Short term needs of O&G Industry

In a survey conducted by the Society of Petroleum Engineers (SPE) in 2012, unconventional reservoirs, deepwater plays, EOR/IOR technologies and heavy oil were cited as the major sources of upstream growth in the coming years [3]. These areas continue to be priority focuses for O&G companies as conventional hydrocarbons are increasingly scarce, however training for facing the challenges related to these plays is rather limited in the universities, so there is a need to improve the teaching and research on these topics.

The human factor is also a key player in performing quality and successful operations within petroleum industry, so soft skills or non-technical skills (NTS's) such as effective communication, decision-making, situational awareness and teamwork should be included in university curricula; a good approach was done by Oklahoma University which opened a new course on the Human Factors in Oil and Gas operations in order to introduce the NTS's required in drilling operations by means of a scenario-based methodology [12].

On the other hand, without a doubt, the hot topic nowadays is the concept of digital oilfield involving the application of science data, artificial intelligence (AI), machine learning and other related subjects. It is evident that the digital industrial revolution is generating large changes in oil and gas business with applications in real time surveillance, image recognition modeling, smart wells and automation, and cyber-physical security of oilfields, among others [2],[4]. In this sense, the incorporation of stronger courses about computer science, programming, and petroleum informatics is a must for updating in petroleum engineering curricula in order to not being behind in the next years.

Another prominent area in the past years and taking more force is HSE; specifically in Colombia it is possible to see several job offers for this area. Here, it is considered that petroleum engineers may take advantage since there is no one more capable to assess the risks and action plans to mitigate them than professionals specialized in the area.

7 Analysis of Petroleum Engineering Curricula in Colombian Universities and Recommendations for Modification

The study included four universities: Universidad Industrial de Santander (UIS), Universidad Surcolombiana (SURCO), Universidad Nacional de Colombia-Sede Medellín (UNAL) and Fundación Universidad de América (FUA), which are the universities with programs on petroleum engineering with more than 20 years of history in Colombia.

Based on the proposed categorization of competencies derived from the learning tool and the new trends discussed about the needs of knowledge in petroleum engineering in the short term, the current curricula of the four petroleum engineering programs were evaluated in order to define the improvement opportunities required for accomplishing the complete list of competencies and new topics described previously. Figure 6 illustrates the correlation evaluated by each university and the corresponding knowledge core (which contains different competencies assessed).

The curricular content was obtained from official university web pages, both regular curricula and offer of elective subjects. The elective subjects are personal-elected subjects that represent between ten and three subjects of the whole curriculum depending on the university.

The four faculties demonstrated strong coverage of fundamentals in the four dimensions as it is the trend worldwide [4]; the subsurface component is the most widely studied and therefore the bases in terms of reservoir engineering and petrophysics should be a strength of graduates. The unique recommendation for this area is to review content relevant to integrated reservoir studies and production forecast given that it is not totally addressed by the subjects offered.

In the area of drilling engineering, the knowledge core of directional drilling is not encompassed in the regular curriculum, however FUA and UNAL have directional drilling as an elective subject. On the other hand, floating drilling is not treated by any university. One recommendation for this aspect is to incorporate the second subject of drilling, although Drilling I and Drilling II are subjects of some curricula, Drilling II is referred to the theory and practice of well completion engineering. In the same context, well completion subject is not considered enough to embark many relevant competencies such as application of special completions in deviated and horizontal wells, description of basic equipment in dual completions, design of a hydraulic fracturing, selection of gravel packers for sand control, among others.

Table 1.

Curricula assessment based on the learning tool outline and new trends of O&G industry

Main Area	Knowledge Core	University			
		UIS	SURCO	UNAL	FUA
Well Engineering	Drilling Equipment				
	Drilling Flow Systems				
	Directional Drilling				
	Floating Drilling				
	Drilling and Completion Fluids				
	Well Completions				
Subsurface	Oil Material Balance with Forecasting				
	Gas Material Balance with Forecasting				
	Petrophysics				
	Petrophyscis focus on permeability				
	Well Performance				
	Well Test Analysis				
	Wireline Logging				
	Reservoir Simulation and Forecasting				
	Petroleum Reserves				
	Integrated Reservoir Study				
	Inmiscible Frontal Advance Theory and Applications				
Production and Operations Engineering	Production Engineering				
	Facilities				
	ALS				
	Field Operations (Workover)				
	Production Data Analysis				
Transversal Disciplines	Knowledge Task				
	General Petroleum Engineering				
	Statistics Applied to Petroleum Engineering				
	Petroleum Economics				
	Petroleum Politics				
New Trends	Soft Skills				
	Unconventional Reservoirs				
	Heavy Oil				
	Offshore Operations				
	Enhanced Oil Recovery EOR				
	Data Science/AI/Related topics				
	HSE and Environment				

UIS: Universidad de Santander, SURCO: Universidad Surcolombiana, UNAL: Universidad Nacional de Colombia, -Medellín, FUA: Fundación Universidad de América.

Knowledge core covered by regular curriculum
Knowledge core covered by elective subjects
Knowledge core not covered

Source: The author based on [13-16].

Regarding production and operations engineering, there is good development of basic concepts in production methods and facilities, nevertheless, artificial lift systems (ALS) and field operations are not entirely covered by the subjects offered. An exceptional case is UNAL that teaches specific subjects on ALS and field operations as part of the regular curricula. SURCO and FUA count on elective subjects of ALS and field operations respectively. The suggestion owing to the importance of practical application of these topics is to incorporate the two subjects depicted as UNAL in the regular curricula. Two of the main weaknesses identified within the analysis were the lack of correlation between statistics and economy concepts (which are taught correctly) and the applications to petroleum engineering. While statistics and probability are part of the four curricula, any of them shows a real link with competencies such as evaluation of uncertainty for reserves estimation and economic appraisal, definition of confidence intervals on permeability estimations, and performing of Monte Carlo simulation for sensitivity and risk analysis in petroleum projects. Additionally, there is a same scenario for economics with an absence of abilities in applying concepts in context like constructing cash flow streams for petroleum projects or evaluating petroleum prospects based on investment yardsticks. For this case, the subjects already exist so the challenge is to orientate the basics toward real competencies of the O&G industry.

Finally, new trends are not studied within the regular curricula, however, there are interesting advancements in creating elective subjects for attending these needs; UIS possess one subject in offshore operations, UNAL has one in unconventional reservoirs and FUA has a subject focused on technologies for heavy oil production. Although soft skills are not part of one determined subject, all of the universities have included subjects about management which explore some non-technical skills for real work. One key proposal from this study is to share experiences in terms of elective subjects in order to standardize the available offer of these optional subjects creating a kind of specialized lines and at the same time facilitating the cooperation among universities. Table 1 provides one insight into some suggestions for this idea which could be a strategy to enable formation for an increasingly demand for specific competencies.

Table 2.
Suggestions on specialized lines to standardize the elective subjects

Specialized Line	Subject 1	Subject 2	Subject 3
Unconventional Reservoirs	Unconventional Reservoir Geomechanics	Hydraulic Fracturing	Unconventional Reservoir Production
Data Science	Introduction to Data Science	Machine Learning	Deep Learning
Offshore Engineering	Introduction to Offshore Engineering	Floating Drilling	Offshore Production
Drilling and Completions	Directional Drilling	Floating Drilling	Completion Engineering II
Reservoir Engineering	Deepening on Petrophysics	Enhanced Oil Recovery (EOR)	Advanced Reservoir Simulation

Source: The author

As a final recommendation, the bulk of suggested and current professional subjects should implement a project-based methodology, since it is proved that this kind of educational approach provides a larger exposure to engineering processes and concepts, soft skills and reality cases [9]. Including the training focused on projects may also enable the application of essential knowledge in real work such as MS Excel use, technical report writing, programming and project planning

which are competencies highly demanded. In the same context, a key factor in shaping the curriculum is industry participation [2], so the new contents should be built along with representatives of operator and services companies, as well as projects could be sourced by real problems in the companies.

8 Conclusions

A learning tool is presented based on the main competencies required for recent graduates according to an international survey conducted by SPE, and the role of providing a consistent instrument to teach the class of introduction to petroleum engineering is described. In addition, current curricula of petroleum engineering in the principal Colombian universities were assessed based on the learning tool outline and new trends of the O&G industry in order to propose recommendations to enhance the professional profile of future petroleum engineers. From this work, the following conclusions can be highlighted:

- A more visual and condensed perspective of the SPE graduate matrix is introduced via filtering of the most required and valued knowledge sets and the reformulation of the matrix structure with three levels: main dimensions, knowledge cores and competencies. The proposed rearrangement is used as an outline for the learning tool development.
- The main features of the learning tool include numbering tracking, sheet linking, pdf exportation, relevant software and book listing, and multiple resources encompassing definitions, images, equations, calculation tables, diagrams and videos.
- The learning tool aims to provide a strong and trustful reference for teaching introduction to petroleum engineering, since this subject should work as a medium for expectations alignment and definition of the most important competencies to be developed during the career for petroleum engineering students.
- The prime recommendations for modification in current curricula are, firstly to add subjects on directional drilling, artificial lift systems, and field operations. In the second place, to provide a better petroleum-approach for statistics and economics subjects in order to create valuable competencies. And last but not least, new trends such as unconventional reservoirs, offshore technologies and data science should be considered to offer elective subjects and specialized lines.

References

[1] British Petroleum. BP Energy Outlook 2019. Available on: https://on.bp.com/2GrPIWX.

[2] I. Ershaghi & D. Paul, The Changing Shape of Petroleum Engineering Education. SPE Annual Technical Conference and Exhibition, 2017.

[3] E. Holderby & M. Van Domelen. Advancing Multidisciplinary Training and Development for Young Professionals in the Oil and Gas Industry. SPE Annual Technical Conference and Exhibition, 2015.

[4] D. Mathieson, D. Meehan & J. Potts, The End of Petroleum Engineering as We Know It. SPE Middle East Oil and Gas Show and Conference, 2019.

[5] Blasingame T., SPE Talent Council. The SPE Technical Knowledge for Graduating Engineers. (2011). Available on: https://www.spe.org/training/docs/graduating_matrix.pdf

[6] Society of Petroleum Engineers. SPE Competency Management Tool. Online resource available on: https://www.spe.org/training/cmt/

[7] T. Aggour, B. Donohue & D. Donohue. Competency Framework for Petroleum Engineering University Graduates. SPE Annual Technical Conference and Exhibition, 2015.

[8] C. Temizel, T. Tuna, B. Jia, D. Putra & R. Moreno. A Practical Petroleum Engineering Toolkit. SPE Kuwait Oil & Gas Show and Conference, 2017.

[9] J. Bryant, G. Salama & M. Fahes. Benefits of Freshman Engineering Projects for Petroleum Engineering Students. SPE Annual Technical Conference and Exhibition, 2010.

[10] T. Aggour, T. Donohue & D. Donohue. Modernizing Petroleum Engineering Education: A New Global Online Petroleum Engineering University Serving all Universities. SPE Annual Technical Conference and Exhibition, 2015.

[11] A. Jain, A. & K. Ogle. A Competency Management Tool for SPE Members. Journal of Petroleum Technology, 67(01), pp.68-72, 2015.

[12] Y. Dadmohammadi, et al. Integrating Human Factors into Petroleum Engineering's Curriculum: Essential Training for Students. SPE Annual Technical Conference and Exhibition, 2017.

[13] Fundación Universidad de América. Official web page [consulted on april 26th, 2019]. Available at: http://www.uamerica.edu.co/programas-academicos/pregrado/ingenieria-de-petroleos/

[14] Universidad Industrial de Santander. Official web page [consulted on april 26th, 2019]. Available at: https://www.uis.edu.co/webUIS/es/academia/facultades/fisicoQuimicas/escuelas/ingenieriaPetroleos/programaAcademicos/ingenieriaPetroleos/planEstudios.html

[15] Universidad Nacional de Colombia-Sede Medellín. Official web page [consulted on april 26th, 2019]. Available at: https://minas.medellin.unal.edu.co/formacion/pregrado/ingenieriadepetroleos

[16] Universidad Surcolombiana. Official web page [consulted on april 26th, 2019]. Available at: https://www.usco.edu.co/es/estudia-en-la-usco/programas-pregrado/facultad-de-ingenieria/ingenieria-de-petroleos/

F. A. Plazas Niño, recibió el título de ingeniero de petróleos con distinción Summa Cum Laude en 2016, de la Universidad Industrial de Santander, Bucaramanga, Colombia. Cuenta con experiencia investigativa en diversas áreas como mercado de gas natural, estabilidad de pozo y daño a la formación. Actualmente se desempeña como profesional de proyectos en la oficina de extensión de la escuela de ingeniería de petróleos de la Universidad Industrial de Santander, sede Bucaramanga. Sus intereses investigativos se encuentran en el área de estadística aplicada en el sector petrolero e investigación de operaciones.
ORCID: 0000-0003-3392-5707

H. M. Galvis Silva, recibió el título de ingeniero de petróleos de la Universidad Industrial de Santander (2015) y magister en ingeniería de hidrocarburos de la misma universidad (2019). Cuenta con más de cinco años de experiencia trabajando en investigación y desarrollo para las áreas de análisis petrofísicos, daño a la formación, aseguramiento de flujo y recobro mejorado. Se desempeñó como gerente de nuevas tecnologías para la compañía ERVS SAS durante tres años, teniendo a cargo el desarrollo e implementación de tecnologías para la optimización del transporte de crudos pesados y aumento del factor recobro.

Actualmente se desempeña como gestor de proyectos y servicios para la escuela
de ingeniería de petróleos de la Universidad Industrial de Santander.
ORCID: 0000-0002-5524-987X