ISBN: 978-628-96613-3-0. ISSN: 2414-6390. Digital Object Identifier: https://dx.doi.org/10.18687/LACCEI2026.1.1.504

Strategies for Integrating Artificial Intelligence Technologies into the Mining Curriculum

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***Abstract*– The mining industry faces new challenges to become more efficient. The ongoing development of AI technologies is not unrelated to this industry. From an educational point of view, it will be necessary to prepare new students who will form, in the short and medium term, work teams in mining operations. In this regard, the role of the university becomes indispensable, given that it must update its curriculum in accordance with industry requirements. This paper presents a preliminary strategy for implementing AI technologies in the curriculum of a mining engineer. The methodology used consisted of identifying stakeholders, forming an internal curriculum committee for the program and an external one (professionals from the sector), and gathering information on the current and future needs of the mining industry. Information was gathered on courses offered by mining schools at prestigious universities. The content was compared, and a preliminary list of courses that should incorporate AI was compiled. Finally, a preliminary budget for implementation was prepared. The program's strengths and weaknesses were also identified. Strengths include ABET accreditation, a continuous improvement plan, and existing IT infrastructure. One of the major weaknesses is the small number of full-time professors and their age range.**

***Keywords*-- Artificial intelligence, mining engineering, continuous improvement.**

I. INTRODUCTION

The mining industry, around the world, is always seeking to optimize its processes, making them more efficient, profitable, and sustainable [1-5]. In recent years, artificial intelligence (AI) appears to offer the necessary tools to achieve this goal [6-10]. Indeed, AI appears to offer an opportunity to provide systems that reason intelligently about the actions and decisions needed to be taken in real time [11]. Based on this, the integration of AI into mining engineering curricula is an unbeatable opportunity to train new professionals with these types of skills and competencies [12-20].

On the other hand, the mining industry in Peru is not immune to modernization and the integration of AI in its various production stages [21,22]. To address this, it is essential to integrate AI into the curricula of academic programs in mining engineering, geological engineering, metallurgical engineering, mechanical engineering, environmental engineering, civil engineering, and other programs that contribute to the formation of professionals directly linked to mining [23-25]. However, in Peru there is still a significant gap in curricula with courses containing AI content [26]. Then, this gap represents an opportunity for the continuous improvement of accredited academic programs. In this sense, a strategy for integrating AI into modern curricula is essential [27]. There are some problems, how in acquiring AI technology, because AI applications systems typically required a strong base of development tools.

This document presents strategies for the incorporation of AI into the Mining Engineering curriculum of an accredited higher education institution, in this case by the Accreditation Board for Engineering and Technology (ABET).

II. METHODOLOGY

A. Overview of mining schools in Peru

For this first stage it will be necessary to acquire information about the study plans of mining schools in Peru. To carry out the respective analysis, statistical data was collected from various sources such as the Peruvian Ministry of Education (MINEDU) [28], the National Superintendence of Education (SUNEDU) [29], and others.

B. Strategic plan for the implementation of AI in the mining engineering curriculum

The incorporation of AI into the Mining Engineering curriculum was carried out following several planning stages:

1) *Identify stakeholders.*
2) *Propose a work plan with objectives, indicators, deadlines, and budget.*
3) *Gather information on the current needs of the mining industry in order to assess whether the profile of the current graduate should be adjusted to the new requirements.*
4) *Evaluate the content of current courses and prioritize foundational courses, capstone courses, and multidisciplinary courses.*
5) *Acquire information on similar curricula in Peru and at prestigious universities abroad.*
6) *Organize group forums with the curriculum committee, the external committee, and alumni to brainstorm ideas.*
7) *Based on emerging trends in the mining industry, a comparison of curricula, and brainstorming, it should be determined whether it is necessary to incorporate new courses or if simply modifying the content of existing courses is sufficient.*
8) *If the latter is the case, priority should be given to incorporating the appropriate percentage of AI content into the selected courses.*
9) *Depending on the percentage of AI to be implemented, it may be necessary to hire new faculty staff, either part-time or full-time, to cover the needs*

of new courses or modified existing courses. For existing faculty staff, it will be necessary to identify the level of competence required to implement AI content in the identified courses. If necessary, newly appointed teaching staff will need to be provided with the necessary skills.

10) *Adaptation of the Program Educational Objectives and Student outcomes, according to ABET guidelines, to the new curriculum.*
11) *Investment budget: It will be necessary to prepare a budget that reflects the investment amounts required for implementation. These expenses may include computer lab infrastructure with high-speed internet and robust platforms for secure data handling, specific software licenses, use of online learning platforms, expansion of cloud storage space, and other related costs.*

C. Continuous improvement

It will be necessary to implement a work plan to monitor and continuously improve the curricular changes made.

III. Results

A. Present situation and historical background of mining engineering program in Peru

In Peru, higher education is offered at both public and private institutions. Currently, there are 27 mining engineering schools, 17 of which are public and 10 privates. Of all of them, 7 are located in Lima and the rest are distributed throughout the country [29]. Of these, only 3 programs are accredited by ABET [30] (Table I).

TABLE I
MINING ENGINEERING SCHOOLS IN PERU

Type	Institution
Private	Pontificia Universidad Católica del Perú (PUCP)[a]
	Universidad Católica de Santa María (UCSM)[a]
	Universidad Católica de Trujillo Benedicto XVI (UCT)
	Universidad César Vallejo S.A.C. (UCV)
	Universidad Científica del Sur S.A.C. (UCSUR)
	Universidad Continental S.A.C. (UCONTINENTAL)
	Universidad de Ingeniería y Tecnología (UTEC)
	Universidad Privada de Trujillo (UPRIT)
	Universidad Privada del Norte S.A.C. (UPN)
	Universidad Tecnológica del Perú S.A.C. (UTP)
Public	Universidad Nacional Daniel Alcides Carrión (UNDAC)
	Universidad Nacional de Cajamarca (UNC)
	Universidad Nacional de Huancavelica (UNH)
	Universidad Nacional de Ingeniería (UNI)a
	Universidad Nacional de Moquegua (UNAM)
	Universidad Nacional de Piura (UNP)
	Universidad Nacional de San Agustín de Arequipa (UNSA)
	Universidad Nacional de San Antonio Abad del Cusco (UNSAAC)
	Universidad Nacional de San Cristóbal de Huamanga (UNSCH)
	Universidad Nacional de Trujillo (UNT)
	Universidad Nacional del Altiplano (UNA)
	Universidad Nacional del Centro del Perú (UNCP)
	Universidad Nacional Jorge Basadre Grohmann (UNJBG)
	Universidad Nacional Mayor de San Marcos (UNMSM)
	Universidad Nacional Micaela Bastidas de Apurímac (UNAMBA)
	Universidad Nacional San Luis Gonzaga (UNICA)
	Universidad Nacional Santiago Antúnez de Mayolo (UNASAM)

[a] Accredited by ABET

PUCP and UNI have the mining engineering program accredited by ABET since 2015, while UCSM since 2023. In addition, PUCP and UNMSM are the only two universities that are among the top 1000 in the QS World University Rankings 2025, in positions 345 and 951 respectively. Furthermore, according to the QS 2025 ranking, PUCP appears as the 5th Mining Engineering school in South America and 51st in the world.

The ABET-accredited mining engineering program at Pontifical Catholic University of Peru (PUCP) was taken as a case study [31].

B. Mining engineering program at PUCP

The mining engineering program at PUCP was implemented in 1969 thanks to the drive of professionals in the mining industry in Peru and the support of the British Government (University of Wales, Cardiff) with the Peruvian Government. Other governments, through the German Technical Cooperation (GTZ) and the Interuniversity Council of the French Community of Belgium (CIUF), strengthened its growth in the mid-1990s. Furthermore, throughout its existence, the mining engineering program has received support from various mining companies.

Currently, the program has 8 full-time and 16 part-time professors.

C. Development of the strategic plan for the implementation of AI in the mining engineering curriculum.

1) Stakeholders

The program has identified the following stakeholders.

- Program Director: elected by the faculty of the section and confirmed by the dean of the faculty. The program director appoints the professors who make up the Program Curriculum Committee.
- Program Curriculum Committee: These are full-time professors with training in mining engineering or related areas, but with experience in the subject.
- External Curriculum Committee: composed primarily of professionals from the mining industry and the public sector related to mining. This committee is formed at the proposal of the program's curriculum committee. The external curriculum committee periodically issues opinions on current trends in the academic training of mining engineers.
- Alumni: Some alumni of the program are invited to give their opinions on the proposed curriculum changes.

- PUCP authorities: It will be necessary to identify the university authorities with decision-making power. In this case, the dean of the School of Science and Engineering, the head of the Department of Engineering, the director of the Academic Directorate for Faculty Affairs, the academic vice rector, and the administrative vice rector.

2) To draw up a roadmap

Table II presents a tentative work plan for the implementation of AI in the Mining Engineering curriculum.

TABLE II
ACTIVITY PLANNING

Objectives	Indicator	Estimated time (month)
Review of the current curriculum	Review report	1
Review of curricula from other universities in Peru	Review report	3
Review of curricula of prestigious foreign universities	Review report	4
Discussions forums with a variety of stakeholders.	Meeting minutes with collected information	4
Gather information on the current needs of the mining industry.	Report	2
Review of faculty staff competencies	Report	2
Infrastructure needs assessment	Proposed new curriculum framework	2
Development of a new curriculum	New educational objectives and student outcomes	1
Adaptation of the program curriculum to ABET considerations	Prepared Budget	1
Preparation of the necessary budget	Improvement plan	1
Development of the continuous improvement plan	Report	2

3) Current needs of the mining industry

Modern mining engineering requires professionals with a combination of advanced technical skills and strong interpersonal skills, including proficiency in automation, data analysis, and AI, as well as leadership, project management, and effective communication to meet the industry's demands for efficiency, safety, and sustainability.

Key technical areas include the use of advanced software, Geographic Information System (GIS), and the operation of robotic systems that enable real-time data management and rapid, concise decision-making. Interpersonal skills primarily focus on English language proficiency, communication, problem-solving, teamwork, continuous learning adaptability, and proactivity, among others.

Among the main aspects related to the demand of the mining industry, we can mention the following [32]:

- Critical minerals demand
- Advanced data management
- Digital transformation in mining operations
- Integration of Artificial Intelligence as part of the Fourth Industrial Revolution
- Sustainability as a driving force

4) Organize group forums with the curriculum committee, the external committee, and alumni to brainstorm ideas.

A preliminary survey regarding the use of Machine Learning in mining courses was sent by mail to the professors and teaching assistants of the mining engineering faculty. The professors of the mining surveying, mine transport, and surface mining courses have expressed favorable opinions regarding the implementation of AI in their respective courses. Table IIII presents the opinions received. A group forum with the external committee and alumni is still pending.

TABLE III
OPINIONS RECEIVED REGARDING THE APPLICATIONS OF MACHINE LEARNING IN THE MINING CYCLE

Course Name	Comments from professors and teaching assistants
Mine Transport	Machine learning can be used for: - Predicting cycle time and fuel consumption to optimize the management of truck loaders. - Predictive maintenance: anticipating failures using sensor data. - Analyzing operational efficiency and safety through the detection of anomalies in trajectories and operator behavior
Mining Topography	Machine Learning in Excel could have a very interesting application in Geological and Mining Surveying, since it works with large volumes of spatial data from total stations, GNSS and drones. Clustering methods (K-Means) would allow grouping areas with similar slopes or altitudes, and regression could help predict elevations or identify unstable areas.
Surface Mining	Machine learning (ML) can be used in open-pit mining to improve safety by predicting ground vibrations caused by blasting. It also enhances efficiency and sustainability by analyzing large datasets for tasks such as optimizing drilling and blasting, predicting ground movement, and automating equipment.

5) Analysis of the current curriculum

Table IV summarizes the preliminary evaluation of the course content in the curriculum of the mining engineering program. Priority has been given to courses from the last years of study, as well as design courses and capstone projects [33].

TABLE IV
COURSES IDENTIFIED WITH POTENTIAL AI APPLICATION IN THEIR CONTENT

Course Name	Potential Applications of AI
Mine Transport	AI-powered systems enable self-driving trucks and drilling systems to operate continuously, increasing productivity and reducing costs. Machine Learning
Drilling and Blasting	Algorithms for optimizing drilling patterns
Statistics for Mining	Data Analysis

Rock Mechanics	Data Analysis
Mining Valuation	Data Analysis
Modelling and Mine Planning	Data Analysis/Simulations
Underground Mining	Data Analysis/Simulations
Surface Mining	Data Analysis/Simulations
Mine Ventilation	Health monitoring: AI-powered wearable devices monitor miners' health, tracking heart rate, fatigue, and exposure to hazardous substances. These devices can alert miners and supervisors in real time to safety issues. Machine Learning
Mineral Processing	Integrate AI into equipment like crushers and sorters to dynamically adjust settings for better grade control, sorting accuracy, and resource efficiency. Machine Learning
Mine Surveying	Manage geospatial data
Thesis Work 1	Tools for research and study
Mining and Environmental	Tools for research and study
Mining Project	Tools for research and study
Thesis Work 2	Tools for research and study
Geology of Ore Deposits	Use AI to analyze geological, satellite, and geophysical data to more accurately identify mineral-rich areas, reducing the need for costly and time-consuming drilling. Machine Learning.

6) ABET and new curriculum.

The Educational Objectives (EO) describe the achievements that Mining Engineering graduates obtain after 3 to 5 years of professional experience [34]. These EOs have been defined considering the opinions of instructors, graduates, employers, and the program's advisory committee.

The implementation of AI, whether by modifying existing courses or implementing new ones, will be part of the continuous improvement plan required by ABET. Furthermore, it must be ensured that the new content does not affect the existing learning outcomes. The educational objectives are detailed below:

- EO1: Technical and analytical skills: apply knowledge and skills in analyzing and solving problems of the mining industry, integrating analytical thinking and conceptual reasoning.
- EO2: Management and leadership ability: work in a cooperative and multidisciplinary team in different cultural settings, in order to demonstrate leadership and effective communication skills, being responsible in decision-making and showing openness to different visions.
- EO3: Capacity for self-learning and continuous improvement in professional performance: demonstrate continuous professional growth through specialization or postgraduate studies that allow reaching new skills and enriching performance in the mining industry.
- EO4: Reflective capacity and ethical commitment: know the impact of mining engineering activity on society and the environment, in order to demonstrate social and ethical responsibility in the exercise of the profession. Achieve sustainable development over time.

The EOs of the courses selected for the implementation of AI tools are shown in following Table. As can be seen in Table V, the EOs of the selected courses are not affected; on the contrary, the changes in their content reinforce these objectives, especially in design or capstone courses such as: Underground Mining, Surface Mining, Modelling and Mine Planning, Mining Project and Mining Valuation.

TABLE V
EDUCATIONAL OBJECTIVES OF THE SELECTED COURSES TO IMPROVE THEIR CONTENT WITH AI

Course Name	Educational Objectives			
	1	*2*	*3*	*4*
Mechanics of Materials for Mining	x	x	x	x
Statistics for Mining	x		x	
Mine Surveying	x		x	
Drilling and Blasting	x	x	x	x
Rock Mechanics	x	x	x	x
Geology of Ore Deposits	x		x	
Mineral Processing	x	x	x	x
Mine Transport	x	x	x	
Underground Mining	x	x	x	x
Mine Ventilation	x	x	x	x
Surface Mining	x	x	x	x
Thesis Work 1	x	x	x	x
Mining and Environmental	x	x		x
Modelling and Mine Planning	x	x	x	x
Mining Project	x	x	x	x
Mining Valuation	x	x	x	x
Thesis Work 2	x	x	x	x

7) Comparison of mining engineering courses offered at prestigious universities abroad.

The selected foreign universities are those with a long mining tradition and that are also among the top 100 universities according to the QS 2025 ranking. The selected universities were:

- Colorado School of Mines, EEUU
- McGill University, Canada
- University of British Columbia, Canada
- University of Alberta, Canada
- University of Arizona, EEUU
- Virginia Tech, EEUU
- Missouri University of Science and Technology (Missouri S&T), EEUU

The results are presented in the following table. This table shows the courses offered by these institutions that are not similar to those offered by PUCP. It also indicates whether the course offered is required or elective. Elective courses belong to the mining engineering curriculum or to a specialization (minor or major).

TABLE VI

MINING ENGINEERING PROGRAM COURSES WITH AI CONTENT AT OTHER UNIVERSITIES.

QS Ranking (2005)		Institution	Courses	Type of curse	
Global	*By Subject* [a]			*Mandatory*	*Optative*
501	1	Colorado School of Mines, EEUU	Mine Planning Software	x	
			Senior Design	x	
29	3	McGill University, Canada	Computer Programming for Physical Sciences and Engineering	x	
			Applied Stochastic Orebody Modelling	x	
			Analysis, Modelling and Optimization in Mineral Processing		x
			Automation of Mining Systems		x
			Introduction Robotics and Intelligent Systems		x
			CAD and computer science for mining		x
38	9	University of British Columbia, Canada	Modelling and Simulation	x	
			Mineral Process Control	x	
96	16	University of Alberta, Canada	Engineering Drawing and Computer Graphics	x	
			Mine Planning and Design	x	
			Mineral Reserve Estimation	x	
			Mine Economics and Analytics		x
			Mine Design Project I		x
			Surface Mining Methods and Operations Management		x
			Underground Mining Methods		x
			Computational Methods in Engineering		x
			Principles of Environmental Modelling and Risk		x
			Practical Programming Methodology		x
			Algorithms I		x
			Introduction to Geographical Information Systems and Remote Sensing		x
			Simulation and Computer Modelling Techniques in Management		x
			Introduction to Design and Analysis of Experiments		x
			Applied Regression Analysis		x
			Statistical Methods for Learning and Data Mining		x
			Time Series Analysis		x
293	32	University of Arizona, EEUU	Mine Planning Software	x	
			Probability and Statistical Concepts in Geologic Media	x	
			Equipment Operations Technology	x	
			Senior Capstone	x	
358	25	Virginia Tech, EEUU	Financial Modelling in Excel		x
			Introduction to Remote Sensing		x
527	51	Missouri University of Science and Technology (Missouri S&T), EEUU	Drone Mapping and Photogrammetry	x	
			Computer Aided Mine Design	x	
			Capstone Design Project	x	
			Mine Atmosphere Control	x	
			Ore Reserve Analysis and Geostatistics	x	
			Principles of Explosives Engineering	x	
			Computer Aided Mine Design	x	

[a] Mineral & Mining Engineering.

8) Curriculum update

Furthermore, the curriculum should be updated to include in some course's specific chapters on data bias, the transparency of "black box" models in critical decision-making, and the impact of automation on mining employment [35]. Since AI systems require a solid foundation of development tools, it would be important for the mining project course to be interdisciplinary with students from other specialties of Computer Engineering or Data Science.

9) Implementation of surveys for enrolled students

In order to gather feedback on the level of familiarity with programming and AI, it will be necessary to conduct a survey of enrolled students. This would help determine whether curricular changes should begin in the first years with introductory courses in computational logic.

10) Faculty staff

To organize AI training for the program's professors' staff, it will be necessary to gather information about their age, computer skills, and dedication to the program. The age range of the professors is distributed as shown in Figure 1 and Figure 2.

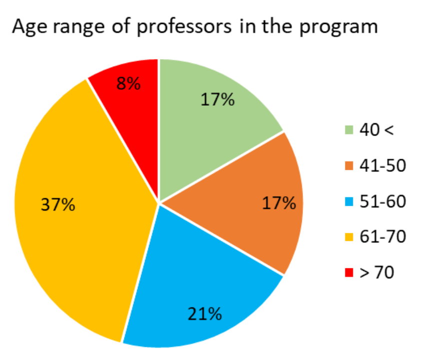

Fig. 1 Distribution of professors in the mining engineering program with full-time and part-time dedication.

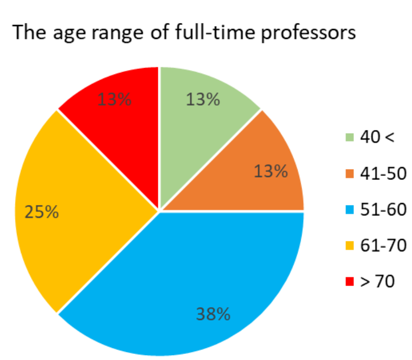

Fig. 2 Distribution of full-time teachers according to their age range.

As can be seen from Fig. 1, the majority of professors (37%) are in the 61-70 age group. On the other hand, if we consider only full-time professors, the largest percentage (38%) is in the 51-60 age range (Fig. 2).

The age range could pose a challenge in terms of training, as implementing AI tools requires specific skills. Therefore, it will be necessary to secure the support of the institution's authorities to attract and hire young professors with the necessary skills. This will ensure the continuity and sustainability of the curriculum changes.

In this regard, a phased training program should be proposed. These phases should include data literacy [36]. That is, the integration of skills to collect, analyze, interpret, and communicate data across all mining-related disciplines, which is essential for fostering critical thinking and informed decision-making among students. Therefore, the following schedule is proposed (Table VIII).

TABLE VIII

SCHEDULE FOR DATA LITERACY TRAINING

Key Components of Data Literacy	Months					
	1	2	3	4	5	6
Reading Data: Understanding where data comes from and its business context.	x	x				
Working with Data: Acquiring, managing, and storing data.			x	x		
Analyzing Data: Using tools and methods to interpret data.				x	x	
Communicating Data: Using data to build arguments and convey meaning					x	x
Practical Applications in Mining.	Months					
	7	8	9	10	11	12
Extraction of massive production and geological data. Tools: SQL, PostgreSQL	x	x	x			
Management of 3D data infrastructures for reserves. Tools: GIS systems, Python		x	x	x		
Identification of patterns in large volumes of rock. Tools: OpenCV, Yolo			x	x	x	
Predictive maintenance of autonomous trucks. Tools: Neural Networks				x	x	x

Likewise, PBL involves the implementation of extended projects that address real-world problems or challenges. The projects are typically interdisciplinary in nature, integrating various subject areas and skills. The focus is on inquiry, research, critical thinking, problem-solving, and creativity. PBL encourages students to work collaboratively, analyze complex issues, and develop innovative solutions. It nurtures the development of 21st-century skills such as collaboration, communication, and self-directed learning.

Then, as part of the evaluation system, Project-Based Learning (PBL) should be implemented, where students can solve a real problem from a Peruvian mining operation using the proposed data and software. Therefore, it will be necessary for teachers who do not have the skills in this type of PBL methodology to also receive training [37-39]. Table IX presents a schedule for the training of teachers and practice supervisors in PLB competencies.

TABLE IX
SCHEDULE FOR CORE TEACHER COMPETENCIES FOR PBL TRAINING

Core Teacher Competencies for PBL	Months							
	1	2	3	4	5	6	7	8
Designing Engaging Problems: Ability to create or curate authentic, ill-structured problems that directly relate to real-world scenarios and curriculum standards.	x							
Facilitation & Scaffolding: Moving from direct instruction to mentoring, guiding student inquiry, and providing "just-in-time" learning.		x	x					
Creating a Collaborative Culture: Establishing safe environments for brainstorming, setting ground rules for group work, and fostering interpersonal skills.			x	x				
Active Assessment & Reflection: Moving beyond summative tests to evaluate the process-critical thinking, collaboration, and self-directed learning-through rubrics and, as outlined in 3. What is the role of the teacher in PBL?, and in 4. Problem-Based Learning and Future-Ready Skills.				x	x			
Technological Integration: Utilizing technology to support student research and presentation of solutions, as suggested on 21K School.					x	x		
Adaptability & Flexibility: Allowing student curiosity to drive learning paths and adapting instruction as the class progresses, according to High Speed Training.						x	x	
Interdisciplinary Knowledge: Connecting the problem to multiple subjects and facilitating a holistic, rather than siloed, understanding, as stated on 21K School.							x	x

11) Definition of Success Metrics (KPIs)

In order to evaluate the achievements of the changes made, it will be necessary to implement Success Metrics (KPIs).

- Number or percentage of professors and teaching assistants who have increased their skills in:
  - Data Literacy
  - GIS systems
  - Python
  - PBL
  - SQL
  - PostgreSQL
- Number or percentage of course chapters that have implemented aspects of AI
- Percentage or number of specialized software licenses acquired.
- Number or percentage of projects with participation of students from other related programs (evidence of interdisciplinarity).
- Percentage of theses or final projects that use AI tools.
- Number or percentage of agreements signed with mining companies for the use of their real-world data in classes.
- Employability rate of graduates in positions requiring advanced digital skills.

12) Informatic facilities

PUCP has IT infrastructure for the entire university community (students, researchers, faculty, and administrative staff). The campus has a local wired network (30 km of fiber optic cable and 504 km of UTP cable). It also has a wireless network (Wi-Fi) with full campus coverage (approximately 1200 access points with speeds between 30 and 80 Mbps).

All students at the University can make use of all the benefits of the computer structure, classrooms, modules, and computer access. The University has deployed IT support alternatives by investing in information technologies to support distance learning, the connectivity fund, and the loan of IT resources, among others.

The Mining Engineering section has two computer labs, as shown in Figures 3 and 4. Details of the courses offered are presented in Table X.

TABLE X
INFORMATICS FACILITIES

Laboratory	Courses
Hochschild Room	Mine Modeling and Planning Mining Project Rock Mechanics Surface Mining Underground mining
Simulation, Drilling and Blasting Laboratory	Mine Surveying Safety and Control

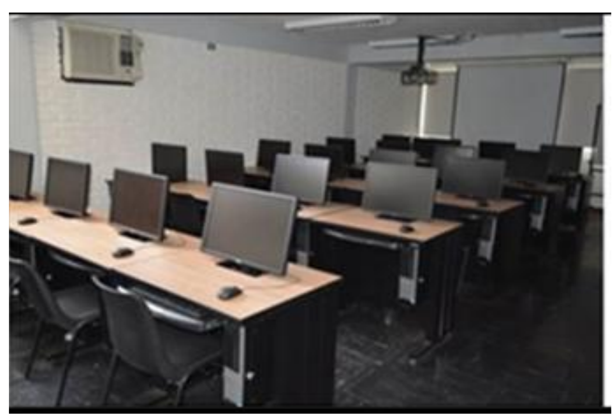

Fig. 3 Hochschild computer laboratory.

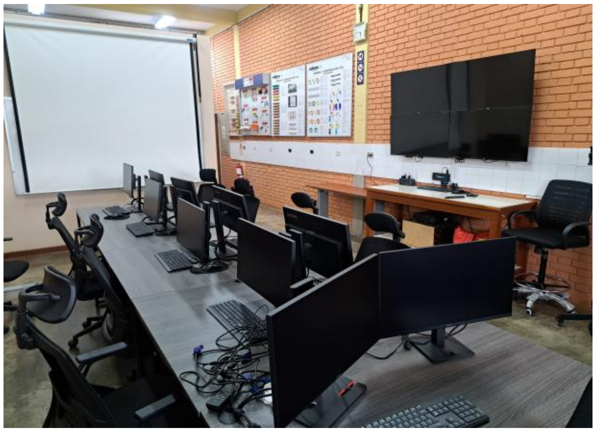

Fig. 4 Mine Surveying computer laboratory

13) Investment budget

In order to implement or enhance digital tools in the teaching-learning process, it will be necessary to enhance the existing educational infrastructure with advanced technologies. In this regard, a tentative budget is presented in Table XI.

TABLE XI
INFORMATICS FACILITIES

Description	Number	Cost (USD)
Additional Datamine Studio RM licenses	21	11765
Additional Datamine Studio OP licenses	21	11765
Additional Datamine Studio UG licenses	21	11765
Workstations with RTX 4070 12 GB, 32 GB RAM, 1TB SSD	21	63000
27" Monitor	21	15441
Interactive display 65″-75″, UHD 4K, internal system, integrated camera/microphone	3	14706
Data storage server	1	19118
Routers, switches and wireless access points (Access Points) to manage the network.	1	5882
Structured cabling (such as twisted pair cables with RJ45 connectors) and/or wireless networks.	1	11765
1 TB AWS data storage, annual fee	1	424
PIX4D, processing drone data	1	1176
SRIZFLY drone simulator software	10	11765
Additional Datamine Studio RM licenses	21	11765
	Total (USD)	178571

IV. CONCLUSIONS

It is possible to develop a strategy for implementing AI technologies in the mining engineering program's curriculum. This strategy should follow a roadmap previously designed by the program's academic director and a curriculum review committee. The course content must be reviewed and adjusted according to the current requirements of the mining industry.

AI-related courses included in the new curriculum must be monitored to ensure they are aligned with industry demands and emerging trends. To achieve this, it will be necessary to develop rubrics that provide information on student outcomes. These results should be shared in workshops and discussions that allow for knowledge exchange, promoting a sustainable and competitive mining industry.

An important factor to consider is that it's not just about reviewing content, but also about assessing the teaching staff's skills and, if necessary, providing them with training. Likewise, it's essential to enhance the educational infrastructure with advanced technologies. In this regard, the institution's support is crucial, as an additional budget will be required.

Finally, it is concluded that every implementation process takes time, so a continuous improvement process should be implemented in parallel.

ACKNOWLEDGMENT

This work has been supported by PUCP, who kindly provided the data.

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