Formative assessments: Model research and simulation for prediction

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Abstract. Currently, the subject "Maintenance Engineering", from the Department of Mechanical Engineering of the University of Santiago de Chile, DIMEC, teaches content that relates the management of data and indicators associated with the logistics of components after industrial maintenance. To evaluating the subject in two research processes, it proposes the acquisition of content in a playful, didactic, and autonomous way for the student, focused on the realization of algorithms, with the possibility of being simulated in the CPN Tools software and generating a bridge. introductory to the use of AI.

Palabras clave: investigation, simulation, formative evaluation

1   Introduction

In the University of Santiago of Chile, the Execution and Civil Mechanical engineering of the DIMEC, have a curricular framework with a gap in technical knowledge, associated with the work reality of the area of reliability and maintenance, where the planned teaching hours are not enough for the technological reality required in the industry. For this reason, the subject has been adapted to the use of Moodle on the virtual campus in the last semesterstaught duringthe pandemic(from 2020 to the endof 2021), where the course is currently taught in person with work on the virtual platform through training and evaluation activities.

In this context, training activities provide students with strengthening soft skills and writing reports and projects. The evaluation of these tools follows the dynamic of autonomous work and self-learning, being one of the options with the greatest impact due to the consolidation of knowledge and its contribution to the area. (Rivadeneira& Silva Bustillos, 2017)

The ability of students to select a topic based on their preferences, discern, and choose useful documents, and recognize the value of the work done through research are some of the advantages of using this evaluation methodology as a measurement tool with respect to knowledge. (Valladares & Espinoza Ramirez, 2019)

2   Theoretical Framekork

2.1   Simulation

Simulation is the opportunity to develop a project prototype, virtually, modifiable, and subject to the conditions given to obtain results. The advantages lie in the savings of physical, economic, and temporal resources, because of its remote management. In education, it proposes the acquisition of experience for students, where its approach to reality and its unlimited use improve knowledge and its subsequent application. (Cherréz Vintimilla & Quevedo Sacoto, 2018)

2.2   Formative Evaluation

According to the Ministry of Education of Chile (MINEDUC), a practice is of a formative nature, when evidence of student performance is obtained, interpreted, and used by the teacher to make decisions about the next steps in the teaching process. Learning (MINEDUC, 2020). Also, Talanquer talks about the low effectiveness of traditional teachingmethods (Talanquer, 2015), beingthe capacity of the teacher in charge andthe interpretation of the results obtained, as the main factor of change to deliver quality education.

3   Method

The methodology to be used follows the operation of the subject planning. For approval, formative evaluations are complementary because their focus on autonomous research by the student, and where the quality of the writing in both phases determines the operation of the algorithm to be carried out in evaluation 2. Therefore, the samples consider the student's efficiency in the topics associated with each evaluation, according to the correction guideline provided by the teacher, with special importance in the remuneration given to the student on evaluation 1, as a base work for carrying out evaluation 2. At the University of Santiago de Chile (USACH), the name for evaluation corresponds to Special Programmed Test (PEP), being PEP1 and PEP2 respectively. The data collected for the school semesters of 2022 are used, with a sample universe of 53 students, 33 for the first period (1S-2022) and 20 for the second period (2S-2022). The Figure 1 describes the student's participation in the green and blue boxes, while the red boxes correspond to the interventions of the teacher and assistant in charge of the course.
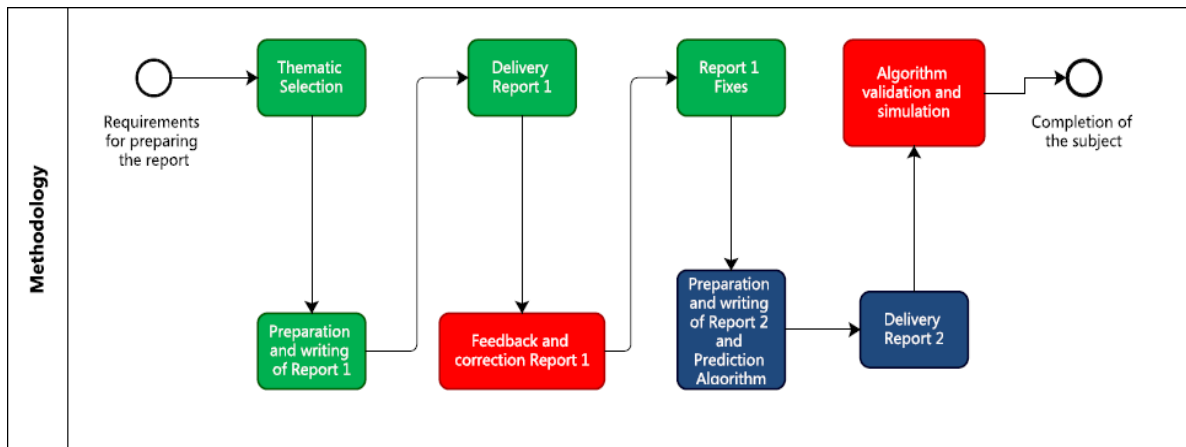
Figure.1: Study methodology for formative evaluations in the subject "Maintenance Engineering"

4   Results

The categories to be evaluated in the report have their importance in the content to be used for both evaluations, with specialemphasison the development of thealgorithm to simulate. The details of the topics are displayed in Table 1 and their weighting in terms of the score obtained by the students.

Table 1: **Score obtained by students in both evaluations, 1st, and 2nd Semester 2022**

Phase	Parameter to evaluate		1S-2022		2S-2022	
		Máx. Score	Aver- age Score	Effisci- ence (%)	Aver- age Score	Effisci- ence (%)
PEP 1	KPI Calculation	5	4,8	96%	5	100%
	Pareto Development (tables and graphics)	9	7,5	83%	7,8	87%
	JK Development (ta- bles and graphics)	9	7,5	83%	7,8	87%
	Data interpretation.	12	10,3	86%	11	92%
	Maintenance Algo- rithm	14	12	85%	13	93%
	Total	35	30,1	86%	31,6	90%
PEP 2	Algorithm and De- scription	7	6	86%	6	86%
	Distribution	7	4,5	64%	4,5	64%
	Model: Petri's Net	8	6,4	80%	6,2	78%
	Simulation: Model Operation	9	8,1	90%	8,2	91%
	Results (KPIs, Quantity, failure rate, etc)	8	5	63%	5,8	73%
	Graphics	7	5	71%	5	71%
	Interpretation of re- sults	8	4,6	58%	4,8	60%
	Total	54	39,6	73%	40,5	75%

5   Discussion

Base on the data collected in Table 1, in both semesters, the efficiency in the development part for PEP1 correspondsto 90%. However, in the caseof PEP2, the efficiency drops to 75%.

The verification of the procedure used, and the information collected for decisions, as the culmination of the report, so, it is important to work on those not so favorable indicators to further increase the effectiveness and performance rates of the students.

6   Conclusions

The general objectiveis met in this research, with indicators higher than 75% in both semesters studied, however, and not exempt from situations of desertion or non-delivery of work, it represents a challenge to improve for future semesters in which teach the subject.

7   Limitations and future research

One of the limitations is in the time dedicated to completing both reports, where the tendency is to resolve it on dates close to the delivery by the students. Therefore, for future research, the proposal is to encourage progressive workanda work methodology.

8 References

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