Programming And Control Of Production In STEAM Environments

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Abstract

(Rifkins, 1996) in his work entitled “The end of work; highlights that "The first revolution came from the hand of coal, the second from the hand of oil, and the exhaustion of oil was what led us to the third revolution", the new needs demanded direct and immediate changes in industrial processes and of transformation, that is why in the mid-70s the inclusion of renewable energies, buildings and harmonious processes with the environment that surrounds them, and increasingly reduced work groups, this last result of the inclusion of computers in the automation of activities. (Granillo Macías, 2019) explains that professionals in industrial engineering and training centers find themselves in a context in which "The implementation of modern training strategies must have the development of specific ICT-based skills, such as Big data, Internet of things and Simulation". It is due to the aforementioned that there is a latent need to appropriate and generate strategic In accordance with the current demands and tools of the globalized market, this document formulates the proposal for the design of Business Intelligence strategies through gamification techniques under the STEAM teaching parameters, in such a way that the base structure of new analysis theories.

Keywords: STEAM, Cloud, programming

Introduction

Decision-making processes within organizations currently represent one of the greatest needs, regarding the knowledge and criteria that future professionals must have, because they must establish minimum factors for analysis and data processing. Likewise, the tools and mechanisms by which the decision models are established or not, mostly depend on the use of programming languages or advanced software. (Pilar, 2012) highlights:

Making decisions is such a daily and ancient activity that we rarely stop to reflect on it. When we have to decide on future, unknown and uncertain situations, many times we do it at random and let luck help us. That attitude, which, although it is very familiar to us, is nothing more than putting the cart before the horse. It is because of these apparently innate notions in many leaders and professionals in charge of
making and analyzing alternatives, that strategies with high imperfections or with very little relevance are formed, since they are not based on numerical data or logical reasons for decision (p. 101).

On the other hand, the inclusion of automation in Industry 3.0 brought with it an enormous challenge in the interpretation and handling of data, since, having an entire operating system through automated equipment, the amount of information on the variables involved in these systems increase, it is due to this last factor, that at that time it became necessary to include means of storage and analysis of said data. Although it is true that the number of tools for information analysis is increasing in many industries; Their interpretation and appropriation capacity in the different scenarios by professionals are low, since "in academic and work processes they are left aside due to the time and cost that their use demands" (Granillo Macías, 2019), without However, new trends demand their inclusion immediately, which is why the need arises to incorporate and familiarize future industry leaders with these, so that the academy is at the level of technological and commercial events that demand the new industrial revolution.

Taking into account the above, the Design of Business Intelligence teaching strategies for an academic program using Gamification techniques in STEAM environments was proposed in this document, to carry out the structuring of these teaching tools, a Descriptive research methodology was integrated. , which sought to consolidate the initial activities regarding the state of the art and identification of the object of study, these actions are described below:

Examine the implementation of Business Intelligence in the academic and training context, by various higher education institutions nationwide.

Carry out a diagnosis of the current state of the program regarding the management and inclusion of new topics of information analysis, ICT management and other technological advances present in the new digital age.

Establish the most appropriate game-based teaching strategies for the insertion of Business Intelligence under the STEAM approach, in the programmatic content of the subjects oriented to the analysis of information in the industrial engineering curriculum.

Analyze the model following the STEAM parameters considering the capabilities and available resources of the program.

To finish, once all these activities have been carried out, a documentary representation was made the practical guide to the design of Business Intelligence tools that best suits the program and the classes taught throughout its curriculum, according to the capacities and resources currently available.

Method

In the development of the project, a Descriptive type of research was applied, according to (Delgado & Cervantes, 2017 "Descriptive research analyzes the characteristics of a population or phenomenon without knowing the relationships between them."); On the other hand (Bustamante, 2013 ) concludes:

Descriptive research can be quantitative or qualitative. It may involve collections of quantitative information that can be tabulated along a continuum in numerical form, such as scores on a test or the number of times a person chooses to use a certain feature of a multimedia program, or it may describe categories of information. such as gender or interaction patterns when using technology in a group situation (p.101).

primary sources . The first-order information was obtained by applying a state of the art, of each of the programmatic contents of the universities accredited in high quality of industrial engineering at a national
level according to the database of the national system of higher education institutions (SNIES), said information was complemented with perceptions obtained through direct observation, analysis and approval of theories already carried out in other documents.

Secondary sources. As a complement to the first order of information, studies carried out in other institutions (background) were taken into account, which retain a certain relationship with the objectives of this project, as well as the existing documentary base such as books or reports.

Analysis of the information.

The information obtained was analyzed using descriptive statistical models and abstract representations of the same (graphics), in such a way that it was possible to identify which are the factors that most influence the design of the model of teaching strategies of Business Intelligence. For the development of these activities, technological and computer tools such as Microsoft Word and Microsoft Excel will be used.

Table 1. Code Execution 1

<table>
<thead>
<tr>
<th>Execution Code 1</th>
<th>% % % Profit maximization exercise from the Pulp library, adapted and edited by % % %</th>
</tr>
</thead>
<tbody>
<tr>
<td>%Library definition Pulp( Linear Programming)###</td>
<td></td>
</tr>
<tr>
<td>from pulp import LpProblem</td>
<td></td>
</tr>
<tr>
<td>from pulp import LpVariable</td>
<td></td>
</tr>
<tr>
<td>from pulp import LpMaximize</td>
<td></td>
</tr>
<tr>
<td>#Definition of exercise variables#</td>
<td></td>
</tr>
<tr>
<td>problem_estrategia2=LpProblem(&quot;maximize_earnings &quot;, sense =LpMaximize)</td>
<td></td>
</tr>
<tr>
<td>garment_1= LpVariable (&quot;x1 &quot;,lowBound =0,upBound= None,cat = int )</td>
<td></td>
</tr>
<tr>
<td>garment_2= LpVariable (&quot;x2 &quot;,lowBound =0,upBound= None,cat = int )</td>
<td></td>
</tr>
<tr>
<td>###Definition objective function of the exercise###</td>
<td></td>
</tr>
<tr>
<td>problem_strategy2 += 15<em>garment_1+10</em>garment_2</td>
<td></td>
</tr>
<tr>
<td>###Definition of exercise restrictions###</td>
<td></td>
</tr>
<tr>
<td>problem_strategy2 +=20<em>garment_1+30</em>garment_2&lt;=60000</td>
<td></td>
</tr>
<tr>
<td>problem_strategy2 +=( 1/30) *garment_1+(1/60)*garment_2&lt;=80</td>
<td></td>
</tr>
<tr>
<td>problem_strategy2 +=3<em>garment_1&gt;=2</em>garment_2</td>
<td></td>
</tr>
<tr>
<td>###Exercise solution###</td>
<td></td>
</tr>
<tr>
<td>problem_strategy2.solve()</td>
<td></td>
</tr>
<tr>
<td>###Print the values of the variables&quot;&quot;&quot;&quot;&quot;&quot;&quot;&quot;</td>
<td></td>
</tr>
<tr>
<td>print (&quot;producedquantityx1={}&quot;). format (garment_1.varValue)</td>
<td></td>
</tr>
<tr>
<td>print (&quot;producedquantityx2={}&quot;). format (garment_2.varValue)</td>
<td></td>
</tr>
<tr>
<td>print(&quot;totalprofit={}&quot;). format (garment_1.varValue<em>15+garment_2.varValue</em>10)</td>
<td></td>
</tr>
<tr>
<td>Results</td>
<td></td>
</tr>
<tr>
<td>quantityproduce1=2100.0</td>
<td></td>
</tr>
<tr>
<td>quantityproduce2=600.0</td>
<td></td>
</tr>
<tr>
<td>profit =37500.0</td>
<td></td>
</tr>
</tbody>
</table>

According to the solution of the model, it is suggested that the company produce 2,100 units of garment 1 and 600 of type 2, to obtain optimal profits of 37,500 Ds.
### Exercise to minimize shipping costs from the Pulp bookstore, adapted and edited by ###
### Felipe Rivera ###

# Library definition Pulp (Linear Programming) ###
rom pulp import LpProblem
from pulp import LpVariable
from pulp import LpMinimize

# Definition of exercise variables#

problem_estrategia3 = LpProblem("minimize_costs ", sense=LpMinimize)

### In this case XAC refers to the number of units that must be sent from source A to destination C ###

XAC= LpVariable("x1 ", lowBound=0, upBound=None, cat=int)
XAD= LpVariable("x2 ", lowBound=0, upBound=None, cat=int)
XAE= LpVariable("x3 ", lowBound=0, upBound=None, cat=int)
XBC= LpVariable("x4 ", lowBound=0, upBound=None, cat=int)
XBD= LpVariable("x5 ", lowBound=0, upBound=None, cat=int)
XBE= LpVariable("x6 ", lowBound=0, upBound=None, cat=int)

cost_XAC = 3

cost_XAD = 4

cost_XAE = 6

cost_XBC = 5

cost_XBD = 3

cost_XBE = 5

### Definition objective function of the exercise ###

problem_strategy3 += (XAC*cost_XAC)+
(XAD*cost_XAD)+(XAE*cost_XAE)+(XBC*cost_XBC)+(XBD*cost_XBD)+(XBE*cost_XBE)

### Definition of exercise restrictions ###

#### Offer Restrictions ####

problem_strategy3 += XAC+XAD+XAE <= 160000
problem_strategy3 += XBC+XBD+XBE <= 120000

#### Demand Constraints ####

problem_strategy3 += XAC+XBC >= 80000
problem_strategy3 += XAD+XBD >= 70000
problem_strategy3 += XAE+XBE >= 90000

### Exercise solution ###

problem_strategy3.solve()

### Print the values of the variables ###

print ("amount to send from x1={}". format ( XAC.varValue))
print ("amount to send from x2={}". format ( XAD.varValue))
print ("amount to send from x3={}". format ( XAE.varValue))
print ("amount to send from x4={}". format ( XBC.varValue))
print ("amount to send from x5={}". format ( XBD.varValue))
print ("amount to send from x6={}". format ( XBE.varValue))

### Print the values of the variables ###

print ("Minimum cost of the operation ={}").format(XAC.varValue*cost_XAC+XAD.varValue*cost_XAD+XAE.varValue*cost_XAE+XBC.varValue*cost_XBC+XBD.varValue*cost_XBD+XBE.varValue*cost_XBE)
After implementing this model in the Python Solver, the Optimal Shipping Solution is obtained.

\[
\begin{align*}
\text{quantity to send of } x_1 &= 80000.0 \\
\text{quantity to send of } x_2 &= 40000.0 \\
\text{quantity to send of } x_3 &= 0.0 \\
\text{quantity to send of } x_4 &= 0.0 \\
\text{quantity to send of } x_5 &= 30000.0 \\
\text{quantity to send of } x_6 &= 90000.0
\end{align*}
\]

The Optimum Value (minimum cost) is $940,000.

Through the linear programming codes, the apprentice will be able to count on optimized problem solving tools, and likewise will be able to find a joint relationship with the real contexts and their problems, in this same way the teacher will have a different resource to explain their problems.

**Table 2. Code Execution 2**

```python
### FLOWSHOP production system code adapted and modeled by Felipe Rivera###

#### We define input variables both machines and tasks in the form of a list####

Machines=["Machine_start","Machine_1","Machine_2","Machine_3"]
Processes=["Process_start","Process_1","Process_2","Process_3","Process_4"]

#### Definition of process time according to the use of the machine####

d_Processes =
(5,10,6,8),
(8,15,5,7),
(8,5,7,9),
(10,7,11,5),
(5,10,6,6)
]

#### We define the process sequence list####

process_sequence =
[0,1,2,3,4]
calendar =[

def add__subtask ( t0, d, i_maq , i_task ):
# subtask dictionary:
subtask = {"t0": t0, "d": d, "i_maq ": i_maq , " i_tarea ": i_tarea }

# Add to calendar
    calendar.append (subtask)
add_subtask ( 0,d_process[1][1],2,1)
print (calendar)

###We schedule production under the FlowShop model:

# Last t0 for each stage:
    tn_stage = [0]* len ( Machines)

# For each task in the sequence:
```

http://www.webology.org
for i_task in process_sequence:
    # For each subtask in the task:
    for i_machine, d_subtask in enumerate(d_Processes[i_task]):
        tn_machine_previous = tn_stage[i_machine-1]
        tn_machine_present = tn_stage[i_machine]

        # Get t0:
        if (i_machine > 0) & (tn_machine_previous > tn_machine_present):
            t0 = tn_machine_previous
        else:
            t0 = tn_machine_present

        # Add scheduled subtask:
        add_subtask(t0, d_subtask, i_machine, i_task)

        # new tn :
        tn_stage[i_machine] = t0 + d_subtask

print(calendar)

import gnt

create_and_show_gantt_fs(calendar, maq_name, tar_name)

Results

With the above code, the industrial engineering student will first be able to learn to become familiar with the Python interface and its respective libraries, as well as having an ideal programming tool to solve workload assignment problems.

conclusions

In the national analysis carried out, it was possible to verify that business intelligence, in the academic context, is taken mostly as a thematic axis of deepening, likewise there are particular cases of application, such as that of the Universidad de los Andes la which integrates this chair within its thematic areas in the undergraduate industrial engineering, it is estimated that on average all high-quality accredited universities in the industrial engineering program integrate programming themes from the 4th to the 6th semester and 41, 7% of these institutions teach courses in applied statistics within their programmatic content.

It was possible to establish that the industrial engineering program currently has an important infrastructure to exploit the new topics of industrial engineering and business intelligence, however this component is not accompanied by specialist teachers in the subject, much less by a curricular mesh. that forms or supports these new topics, there are currently 5 teachers whose master's degrees are in industrial engineering, but the vast majority have approaches other than those required.

In order to establish business intelligence as a thematic axis within the curriculum of the program, basic notions of data programming must first be promoted, as well as a contextualization of the use of programming consoles, for this the opportunity to integrate various real problems in the different subjects...
of the curriculum, of which some were taken as an example in the design of strategies, through the latter it was possible to observe that data programming and business intelligence depend mostly on the existence of volumes of data, for which those subjects whose theoretical base is qualitative, have a difficult inclusion of these tools.

The STEAM model in the future in the program can be executed effectively, since there are favorable conditions for the achievement of multiple institutional objectives, however, with regard to business intelligence, there is a wide margin for inclusion since currently the program lacks any training line of this new tool.

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