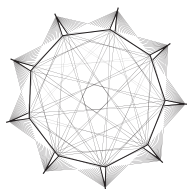


Bonds & Bridges

*Facing the Challenges of the Globalizing World
with the Use of Simulation and Gaming*



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PPC GAME: EXPERIENTIAL LEARNING AS A TOOL TO TEACH PLANNING AND PRODUCTION CONTROL

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ABSTRACT

The activity of adult education must seek new approaches that create an immersive atmosphere in order to attract and wake in the student the need of learning. Only expository lessons have proven to be less efficient in learning. The student should leave the position of listener a typically passive act to a more participative role. Thus, experiential learning appears as a strong ally in the improvement of teaching in universities because it allows the simulation of situations that will be experienced by future professionals, facilitating the understanding and assimilation of the content broadcast. In this work the experiential approach was used in the discipline of Planning and Control Production showing results that validate the importance of experience to education.

1. INTRODUCTION

In Brazil there is a saying that teaching is an art. But art undergoes a transformation over time, reflecting changes in society and its trends. The same thing happens with forms of teaching, which must evolve to achieve better learning outcomes.

The widespread use of electronic media, social networks and digital interactivity makes the teachers work more difficult, because the traditional forms of education no longer can hold the attention of students. So there must be a structural change, where the passive attitude of the student body needs to acquire an active role in the learning process, creating a form of dialectic between teacher and students.

To do this we must abandon the cognitive practice entirely, in which the student is required to take a course to fulfill the course curriculum, without, however, seeing any practical importance. The teacher must stimulate the student to take an active role in the learning process. This goal can be achieved by the experiential approach, which, according to Roger (1985), presents a better outcome because the individual can understand the need of that knowledge. Also according to the author, interest and motivation achieved through the experiential approach are essential to successful learning. In the author's opinion significant learning is one that can provoke a change, either in the individual's behavior in the direction of future action that they select or in their attitudes and their personality.

In the educational institution which has implemented the PPC game, the Planning and Production Control discipline, had been experiencing a high failure rate of students (about 28.5% per class). This problem also affected the productivity classes and knowledge retention by students. In this scenario, teachers decided to include the game in the dynamics of their classes.

With this aim was the PPC GAME was developed and implemented. The PPC GAME has the main purpose to simulate practical situations experienced in the role of planning and production control.

2. EXPERIENTIAL LEARNING

Experiential learning supports the main idea of the importance of experience in the learning process.

According to KOLB (1984) the experiential learning is "the process whereby knowledge is created through the transformation experience. Knowledge results from the combination of grasping and transforming experience".

Experiential Learning (Wolfe and Byrne, 1975) is divided into four distinct and complementary parts:

Design: focuses on the initial efforts by the learning facilitator to set the phases of the program. Define educational goals, producing or selecting activities to be performed by participants, identifying the factors that affect the learning process and creating an implementation plan. This is the phase where the theoretical bases are defined so that participants may visualize the experience within the desired context.

Conduct: conducting and controlling the project designed in the previous phase. The previous design of the activities may be changed to ensure adequate involvement with learning. The implication of this phase is making the experience not only structured, but also closely monitored.

Evaluation: this phase, usually conducted by the facilitator, is focused on the participants, who evaluate the experience they have been through. They must be able to express themselves clearly and demonstrate aspects of learning they have just acquired by the conduct of the experience.

Feedback: this should be almost a continuous process throughout the experience, from beginning to end. By monitoring the process, the facilitator reinforces the positive aspects that have arisen and mitigates – or even eliminates – the negative ones. It is important to stress to the participants that failing is allowed, knowing that mistakes teach us to do it right.

These four stages were considered while developing the TGE PPC GAME so that they were attained, in full, the gains offered by experiential learning.

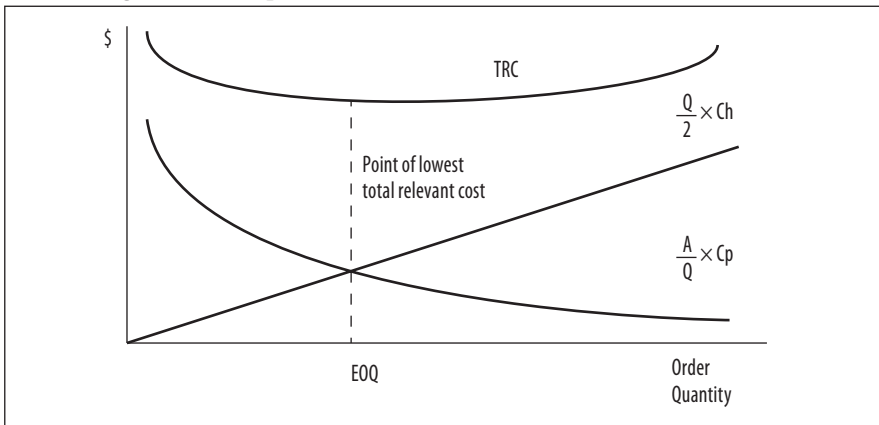
3. ITEMS WORKED IN THE GAME

The game of PPC was developed as a tool to aid in learning the discipline of Planning Production Control. Thus, we analyzed topics related to the aforementioned discipline, which could contribute to the desired goal. Thus, the Game of PPC was prepared to work the following main points:

- **Material Requirements Planning (MRP):** At this point the player develops the ability to make purchases aligned with sales demand, always with the desire not to generate too high inventory, which affects the company's costs, but does not keep them too low as to put in risk the flow of production and delivery to customers. For this the player needs to establish policies for the safety of stock and the choice of suppliers.
- **Product Structure:** This item is part of the creative phase of the game where each team develops a prototype that meets the characteristics desired by the market. At this stage students begin to realize that the creation of final products of great complexity affects the subsequent management of the stock, because they generate a greater number of SKUs. Thus, the concept of standardization of raw material is transmitted, which allows, in addition to a process that facilitates the acquisition and storage of raw materials, also the possibility of exchange parts between various end products.
- **Economy of scale:** the game approaches the mass series production, so the concept of economy of scale is very important and can be measured during the game.
- **Uncertainty in the timeliness of delivery by suppliers (lead time):** One of the realities faced by companies is the unpunctuality of some suppli-

ers. This can cause major damage because they can cause, among other things, stopping the production line and the loss of a client. During the game are simulated delays of suppliers which leads players to make purchases in other emergency providers. At this point, the players understand the importance of choice of suppliers not only considering the cost of acquisition of goods but also other costs that may be incurred, for example, costs related to stock-outs.

- **Market demand:** another major issue faced by companies is the knowledge of market demand. Its absence may cause the non-fulfillment of orders or, on the other hand, the increase of products in stock. During the game the students face situations in which demand suffers change, causing one of the problems cited.



Where: Q : quantity
 $Q/2 * Ch$: carrying costs
 $A/Q * Cp$: ordering costs

Figure 1. Economic Order Quantity

- **Economic Order Quantity (EOQ):** decide how much to buy is a key point in the planning and production control. Do not buy too much or too little, but buying the right amount is what is expected of the manager. But the determination of this quantity requires an understanding of certain factors. The purchase of larger amounts may be tempting because they usually come attached to substantial price discounts. However, as shown in Figure 1, this decision should take into account that the surplus amount will increase the costs of storage ($Q / 2 * Ch$) and that perhaps the discount on acquisition ($A / Q * Cp$) does not outweigh the additional cost of storage. At the moment students begin to realize in practice the concept of Economic Order Quantity (EOQ), which seeks a balance between the discounts for larger quantities and additional ones generated by this system, providing the optimum amount to be gained by the organization, which in turn presents the minimum cost.

- The profit margin and production planning: companies in the same industry have different profit margins that are certainly related to the decisions that were made in the past. In the end, in the comparison of results obtained by each group, the players realize that the different strategies chosen by each team, has led to different financial results. The choices of different suppliers, the quantities of resupply and the quantity to be stored will lead each group to achieve a profit margin differently, so it is clear to the importance of planning and production control for the company's financial results.

4. PPC GAME

The teams are composed of five students who receive the manual with the information necessary for the conduct of the game. The interruptions made by the facilitator are not seen in the manual of the students who do not know when they will happen.

Overall, the game involves the creation, production and costing of a car that uses as raw material, building blocks according to Figure 2.



Figure 2. Building Blocks

The game consists of three distinct phases that must necessarily be carried out in sequence, because there is interdependence between them. The phases are:

4.1. Phase 1: Creative

At this stage the participating groups need to develop a prototype car that meets the requirements of the market informed in the game manual. The creations are free but must meet the minimum requirements.

Each team receives the same number of building blocks and a list of the cost of individual parts, suppliers and their inventory (the stock is shared by all groups and managed by the facilitator), delivery times, lots of minimum sale and the unit cost of storage of each block.

This phase is of great importance, since all others will be held with the product structure achieved here.

Initially, the groups have thirty minutes to build their prototype and to prepare the technical structure of the product.

After this initial period the facilitator stops the game and examines each of the prototypes built and provides the necessary feedback to each group. The main points developed by the facilitator at this point are the amount overstated the number of different pieces and the inordinate amount of the total number of parts. He must demonstrate that the use of fewer types of parts will help the economy of scale in the time of purchase, and facilitate inventory management which will have a smaller number of SKUs. The smallest amount of total parts affects the final cost of the vehicle; it will increase the cost of raw materials and labor.

Following this intervention, the facilitator provides another twenty minutes for groups to discuss the new information and consider its prototype. After this deadline is changes in the prototypes are no longer permitted and each group must deliver to the facilitator the final structure of the product and pictures of the prototype.

4.2. Phase 2: Final Prototype Costs

At this stage each group will work exclusively with the product structure developed in Phase 1. The cost of the prototype will consider only the costs of raw materials and the cost of labor. At this stage the raw material costs do not consider the discounts obtained by quantity.

The Facilitator's role is to inform participants of the cost of labor, who will be directly proportional to the total number of parts used in the vehicle. Thus, prototypes have used a large number of parts that will be charged for labor increase, according to the feedback discussed in the Phase 1.

4.3. Phase 3: Final Costs of the Vehicle in the Production Stage

The main difference to the previous phase is that groups are required to make decisions regarding the choice of suppliers (including cost and delivery date), quantities purchased, the exact timing of purchases (not to miss or leftover inventory) and the necessity of safety stock. To do this work the groups receive a weekly production plan for a quarter of production.

This means that even if, by chance, two groups had the same prototype designed and thus achieved similar results in phase 1 and 2, at the

end of phase 3 the two groups would not show the same results, because there are several decisions to be made in this phase.

These decisions have as a main objective to reduce the final cost of manufacture of each vehicle, increasing the profit of each company.

At this stage the facilitator makes several interventions by creating unusual circumstances that make it difficult for groups. Feedback is given at the same time. The main interventions are:

- Cancellation of orders: this time the group opted to buy from suppliers with a greater lead time and will be more impaired with increasing storage costs;
- Increased demand: With this information the groups need to look for suppliers that still have stock and are able to meet the new demands on time;
- Failure or delay in the delivery of raw materials.

This phase lasts for one hundred and twenty minutes and at the end each group must submit a plan of materials capable of meeting the production plan delivered at the beginning of this phase. According to Slack (2009) Material Requirement Planning (MRP) must provide to the manager the information of what, how and when to buy. Thus the plan shall include:

- What to buy: what materials should be purchased for that period of production. Remember that some of them may already be in stock in sufficient quantity to meet the production plan. They should also indicate the chosen suppliers for any raw materials to be acquired.
- How to buy: the teams must report the quantities of individual purchases to be made, considering the economic order quantity.
- When buying: according to the production schedule, teams should indicate the exact timing for each of the purchase orders are released. The late release can cause the stoppage of the production line or the need to seek ways to transport faster and therefore more expensive. Having an early release will lead to higher inventory levels and consequently the costs associated with it.

4.4. Evaluation Criteria

The final evaluation of the groups is based on two different criteria.

- First criterion (C1). It takes into account the final cost of vehicle production. By this criterion the winner is the group that presented the vehicle, meeting the specifications of the market, has the lowest cost after phase 3. The first group receives 10 points (maximum degree) and the others received lower grades that are proportional to achieved costs.
- Second criterion (C2) takes into account the percentage reduction in cost between the values obtained in phase 2 (prototype) and phase 3 (production). This criterion evaluates the quality of decisions. Thus,

even a group that has built an expensive prototype could be the winner on this criterion, since its strategies to reach a higher percentage of reduction, when compared with other groups. The first group receives 10 points (maximum degree) and the others received lower scores in proportion to the percentage achieved.

The final grade (G) is obtained by the following formula:

$$G = (0,3 \times C1) + (0,7 \times C2) \quad \text{formula A}$$

5. PPC GAME EVALUATION

The semester has the duration of four months, excluding the periods in which students perform tests. There was a mix between theory and practice, so the game can last throughout the semester, with several rounds where students had to make decisions based on the concepts transmitted and experience accumulated during the rounds predecessors.

As time passed it was clear an increase in the involvement of students with discipline, generating strong teamwork and a natural competitiveness between the teams. That has allowed the increase of student attendance and participation in discussions of the discipline content.

6. CONCLUSIONS

The discipline of Planning and Production Control is taught in a semester in Industrial Management Course from the Federal Center of Technology, Rio de Janeiro.

Previously classes were taught only as expository and although the students had to resolve some case studies, there wasn't a strong interaction between students and teacher, and there weren't opportunities to simulate practical situations experienced in daily life on the factory floor.

Consequently, some concepts were difficult to be assimilated by the students and this reflected in the scores achieved by them in the discipline writing tests. The database showed that the average obtained in the last eight semesters was 5.2 (being the maximum degree of 10.0) and student's failure rate was 28.5%.

After introducing the concept of experiential approach and the PPC GAME the scenario changed completely. Students now have greater attendance in the classroom, greater interest and participation. Consequently the main concepts were more easily assimilated and this is proven by the increase of the students' average score to 6.8 and decrease of the percentage of student's failure rate to 13.6%.

REFERENCES

- Kolb D.A. (1984) *Experiential Learning: Experience as the source of learning and development*. New Jersey: Prentice Hall.
- Roger C.R (1985) *Liberdade de aprender em nossa década*. Porto Alegre: Artes Médicas.
- Slack N., Chambers S. (2009) *Administração da Produção*. São Paulo: Atlas.
- Wolfe D.E., Byrne E.T. (1975) Research on Experiential Learning: enhancing the Process. *Simulations Games and Experiential Learning in Action*. BUSKIRK, R.H.