Statistical Significance between Student Motivation, Traditional Teaching and Problem-Based Learning Strategy

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Abstract

The association between student motivation, traditional teaching and problem-based learning was analyzed in 950 students of the engineering programs of the University of Cartagena between 2014 and 2016. The motivation was evaluated using the instrument designed by Lindner et al (1993) called "Inventory of Self-Regulation of Learning" (Cronbach's Alpha = 0.90). The academic teaching strategy: Problem-based learning was assessed using two (2) questionnaires. The first one evaluates the sessions of the Learning based on problems, tutor-student related to the evaluation of student performance in tutorial sessions. This instrument was validated by Valle et. al (1999) in Martínez (2007) (Cronbach's Alpha = 0.96), the second, evaluates the students' perception of their tutor through the evaluation scale of essential elements of tutor performance, designed by Dolmans, Wolfgahgen and Snellen Belendong (1994) (Cronbach's Alpha = 0.87), which evaluates the tutor's performance and competence. The traditional teaching strategy was evaluated using the CEMEDEPU questionnaire designed and validated by Gargallo et. al (2011) which was modified for the research requirements and validated by Alfa de Cronbach which yielded a value of 0.87. For the relationship analysis, the variables were crossed and the bar diagrams and the 2x2 contingency tables were constructed applying the Chi-Square independence test. The results
indicate that there is a significant degree of statistical significance (p <0.05) between student motivation and problem-based learning strategy (p = 0.024) at a confidence level of 95%.

**Keywords:** Motivation, Traditional Teaching, Problem-Based Learning

**Introduction**

For Palmero & Sánchez (2008) motivation is understood as that process that allows reaching goals through planning, maintenance and persistence processes through positive behavior [1]. Likewise, Okagaki & Sternberg (1993) consider that the learning activity of students is conditioned by three factors: motivation, metacognition and cognition [2]. In the same way Martin & Rodriguez (2003) consider that the professor must adapt his teaching style to the learning style preferred by his students. For this, the professor must provide learning situations that provoke a change of attitude and motivation of the student towards their educational processes [3, 4].

According to Woods (1994), problem-based learning (PBL) is one of the teaching methods that has been widely accepted in educational and university institutions in recent years [5]. For Barrows and Tamblyn (1980) solving a problem using the problem-based learning method (PBL) consists of three phases: in the first, the problem is presented, in the second, the necessary competences and learning needs are identified, looking for the required information. In the third, you return to the original problem with the necessary tools to solve it. On the other hand, in the traditional learning process, initially the information is presented and then the strategies are sought to apply them in a contextualized way [6].

For Segura (2006) traditional teaching-learning strategies have focused on the memorization and repetition of information and thematic contents causing that only generate in the students abilities to reproduce ideas to the detriment of a true significant learning where the student demonstrates competence and reasoning skills [7]. Poot (2013) considers that in traditional learning processes, students express that they do not know how to use in a contextualized way what they have learned in the classroom. This can be found articulated to the little or scarce reading that today's students do of the support materials, using on the contrary, strategies that only allow you to remember a speech in a rot way for short periods of time and to give answers only to immediate situations [8].

In the present investigation the association between student motivation of university students with the academic strategy of problem-based teaching was evaluated and the traditional teaching strategy.

**Materials and Methods**

**Population and sample size:** The study participants were regular students of the fourth semester of the programs of Civil Engineering, Systems, Chemistry and Food
of the University of Cartagena. Of the total, 75% were male and 25% female. The ages of the students were between 17 and 21 years old. To estimate the size of the sample when it comes to a finite population of less than 100,000 individuals is calculated according to Fong et al. (2017) \[9\] by equation (1):

\[
N = \frac{\sigma^2npq}{e^2(n - 1) + \sigma^2pq}
\]  

\(\sigma\): Level of confidence or risk chosen; \(p\): Probability that an element is selected (% estimated); \(q\): Probability that an element is not selected \((q = p)\); \(e\): Error allowed; \(N\): Number of elements that the sample must have; \(n\): Number of population elements.

**Variables, phases, instruments and reliability of the test:** The variables used in the research were classified into two (2) categories (independent and dependent):

a. Independent variables: Problem-based learning strategy and traditional teaching strategy.

b. Dependent variable: Motivation

The research was carried out in three (3) phases: In the first one, the degree of motivation of engineering students was identified through a survey. In the second phase, the number of professors using the problem-based learning strategy and the traditional teaching strategy was evaluated. In phase 3, the independent variables are crossed with the dependent variable motivation constructing the bar diagram of the relational analysis.

**Instruments:**

The motivation was evaluated using the instrument designed by Lindner et al (1993) \[10\] called "Inventory of Self-Regulation of Learning". The academic teaching strategy: Problem-based learning (student-centered) was assessed through two (2) questionnaires. The first one evaluates the sessions of the Learning based on problems, tutor-student, related to the evaluation of student performance in tutorial sessions. This instrument was validated by Valle et. al (1999) in Martínez (2007) (Cronbach's alpha = 0.96), which consists of 24 items grouped in the following three (3) dimensions: independent study, reasoning skills and group interaction \[11\]. The second one evaluates the students' perception of their tutor through the scale of evaluation of essential elements of tutor performance, designed by Dolmans, Woflghagen and Snellen Belendong (1994) (Cronbach's Alpha = 0.87), which evaluates the performance and competence of the tutor \[12\].

The traditional teaching strategy was evaluated using the CEMEDEPU questionnaire (Teaching Methodology Evaluation Questionnaire and Methodology Evaluative of University Professors) designed and validated by Gargallo et. al (2011) \[13\].
The dependent variable Motivation was classified into two categories: a) Low motivation (LM) (LM <75 points or less) and high motivation (HM) (HM≥75 points out of a total of 100 points).

The independent variables were classified into three categories: a) Problem-based learning strategy: low learning based on problems (SLPBL) (score lower than 70; SLPBL <70 points) and high problem-based learning (SHPBL) (score equal to or greater than 70 points; SHPBL≥70 out of a total of 100 points). b) Traditional teaching strategy: Low traditional teaching LTT (LTT <70 points) and high traditional teaching (HTT) (HTT≥70 out of a total of 100 points).

To determine the reliability of the test the internal consistency was determined using the Cronbach Alpha [14].

**Statistic analysis:** The Chi-square test [15] between the dependent variable (Motivation) and the independent variables (Problem-based learning strategy and Traditional teaching strategy) was used to know which of these factors are related to each other in engineering students at the University of Cartagena.

**Results and Discussion**

According to equation 1, with a confidence level of 95%, a sample size of 274 individuals is obtained. When applying the surveys, a total of 12 students per academic period and per program (4 programs, 6 academic periods) were made homogeneously for a total of 288 respondents.

The Cronbach's Alpha [14] for the instruments Self-regulation of Learning Inventory, CEMEDEPU and the academic strategy teaching questionnaire: Problem-based learning (centered on the student) yielded the following values: 0.90, 0.87 and 0.92 respectively. It is important to note that problem-based learning was assessed using the following questionnaires: questionnaire 1: tutor-student; Cronbach's alpha = 0.96; questionnaire 2: tutor performance; Cronbach's alpha = 0.87. The Cronbach alpha average of questionnaires 1 and 2 gave a value of 0.92, which corresponds to the value presented above for the academic strategy teaching questionnaire: Problem-based learning. These values indicate a high degree of internal consistency of each of the tests.

The Chi-square test was evaluated for the analysis of the relationship between the dependent variable Motivation and the independent variables (traditional teaching and problem-based learning).

Table 1 additionally indicates the values of p (statistical significance), which also shows that there is a relationship of high statistical significance between the motivation and the teaching strategy: problem-based learning (p <0.05).
Statistical significance between student motivation ...

**Table 1 Chi-Square Test for Student Motivation**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chi-square</th>
<th>GL</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem-Based Learning Strategy</td>
<td>5.09</td>
<td>1</td>
<td>0.024</td>
</tr>
<tr>
<td>Strategy: Traditional teaching</td>
<td>0.52</td>
<td>1</td>
<td>0.4694</td>
</tr>
</tbody>
</table>

** Relationship with high statistical significance at a confidence level of 95%**

In Figure 1, the bar graph is shown between the motivation and the problem-based teaching-learning strategy.

**Figure 1. Bar chart: Motivation- Problem-based learning**

The 32.4% (70 cases) of the students developed high motivation by continually employing (high) the pedagogical strategy: problem-based learning. This is because students are continuously motivated each time the professor uses the pedagogical strategy: problem-based learning, where motivation, metacognition and cognition are put to the test in contextualized learning situations and / or related to real life cases according to Palmero & Sánchez (2008), Okagaki & Sternberg (1993), Martin & Rodriguez (2003) [1,2,3,4]. The 16.7% (36 cases) of the students developed a low motivation when using intermittently (low) the pedagogical strategy: problem-based learning. This is because the student loses interest by not being in the classroom with situations typical of their professional work. Also, the student loses motivation before so much information presented by the professor and little contextualized according to the postulates of Barrows and Tamblyn (1980) [6].

On the other hand, these students make more use of memorization and repetition techniques which directly affects their significant learning processes, causing a decrease in their motivational processes as proposed by Segura (2006) [7]. 5. 1% (11 cases) of students developed a high motivation for intermittent (low) use of the pedagogical strategy: problem-based learning. This is due to the technique, that is,
the mere fact of intermittently using the technique to motivate and increase the student's attitudinal processes towards learning using the pedagogical strategy of problem-based learning allowed to significantly increase student motivation.
Likewise, the student finds meaning in the academic exercise due to the contextualized way in which the information is presented to them, as proposed by Barrows and Tamblyn (1980) [6].

The 45.8% (99 cases) of the students developed low motivation while continuously using (high) the pedagogical strategy: problem-based learning. This is likely due to the clash between the traditional paradigm and the new paradigm of problem-based learning since many students still develop processes of memorization, repetition of contents and do not develop skills or reasoning competences according to what was proposed by Segura (2006) [7]. In the same way, it is very likely that these students still maintain the vices of the traditional teaching strategy such as the shortage in reading, little research and low reasoning according to what was proposed by Poot (2013) [8].

No statistical significance could be verified between the motivation and the teaching pedagogical strategy: traditional teaching.

**Conclusion**

Based on the analysis as above, it is concluded as follow: There is statistical significance at a 95% confidence level between student motivation and problem-based learning teaching strategy. This is because the learning processes contextualized to contextual problems are more striking for professors and students. The students who participated in the study solved the problem under study as follows: first identifying it, second evaluating the possible concepts and strategies and third, returning to the original problem with enough tools to solve it. It was not possible to verify statistical significance between student motivation and the traditional teaching strategy at a 95% level of confidence. This may be due to the fact that this type of teaching-learning processes are concentrated in memorization processes, repetition of information and thematic contents inhibiting the development of skills and competences in students.

**References**


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