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# Problem-Based learning in cardiopulmonary resuscitation: basic life support

APRENDIZAGEM BASEADA EM PROBLEMAS EM RESSUSCITAÇÃO CARDIOPULMONAR: SUPORTE BÁSICO DE VIDA

APRENDIZAJE BASADO EN PROBLEMAS PARA LA RESUCITACIÓN CARDIOPULMONAR: SOPORTE BÁSICO DE VIDA

Pedro Miguel Garcez Sardo<sup>1</sup>, Grace Terezinha Marcon Dal Sasso<sup>2</sup>

## ABSTRACT

Descriptive and exploratory study, aimed to develop an educational practice of Problem-Based Learning in CPR/BLS with 24 students in the third stage of the Nursing Undergraduate Course in a University in the Southern region of Brazil. The study used the PBL methodology, focused on *problem situations* of cardiopulmonary arrest, and was approved by the CONEP. The methodological strategies for data collection, such as participative observation and questionnaires to evaluate the learning, the educational practices and their methodology, allowed for grouping the results in: students' expectations; group activities; individual activities; practical activities; evaluation of the meetings and their methodology. The study showed that PBL allows the educator to evaluate the academic learning process in several dimensions, functioning as a motivating factor for both the educator and the student, because it allows the theoretical-practical integration in an integrated learning process.

## KEY WORDS

Problem-based learning.  
Education, nursing.  
Cardiopulmonary resuscitation.  
Students, nursing.

## RESUMO

Este é um estudo descritivo e exploratório, que objetivou desenvolver uma prática educativa de Aprendizagem Baseada em Problemas em RCP/SBV com 24 acadêmicos da 3ª Fase do Curso de Graduação em Enfermagem de uma Universidade da Região Sul do Brasil. O estudo utilizou a metodologia de ABP enfocando *situações problemas* de PCP e foi aprovado pelo CONEP. As estratégias metodológicas de coleta de dados, como a observação participante e os questionários para avaliação da aprendizagem, da prática educativa e da sua metodologia permitiram agrupar os resultados em: expectativas dos acadêmicos; atividades de grupo; atividades individuais; atividades práticas; avaliação dos encontros e da sua metodologia. O estudo evidenciou que a ABP permite ao educador avaliar o processo de aprendizagem do acadêmico em várias dimensões, e funciona como um fator motivacional tanto do educador quanto do educando porque permite a integração teórico-prática num processo integrado de aprendizagem.

## DESCRIPTORES

Aprendizagem baseada em problemas.  
Educação em enfermagem.  
Ressuscitação cardiopulmonar.  
Estudantes de enfermagem.

## RESUMEN

Estudio descriptivo y exploratorio, que objetivó realizar una práctica educativa de Aprendizaje Basado en Problemas RCP/SBV con 24 estudiantes del 3er año del Curso de Pre-grado en Enfermería de una Universidad de la Región Sur del Brasil. El estudio aprobado por el CONEP utilizó la metodología del ABP enfocando *situaciones problemas* de RCP. La recolección de datos realizada a través de observación participativa y cuestionarios para evaluación del aprendizaje, de la práctica educativa y de su metodología, permitieron de esta forma agrupar los resultados en: expectativas de los estudiantes, actividades de grupo, actividades individuales, actividades prácticas, evaluación de las reuniones y de su metodología. El estudio mostró que el ABP permite al educador evaluar el proceso de aprendizaje del alumno en varias dimensiones y funciona como un factor motivador tanto del educador como del educando, pues permite la integración teórico-práctica en un proceso integral de aprendizaje.

## DESCRIPTORES

Aprendizaje basado en problemas.  
Educación en enfermería.  
Resucitación cardiopulmonar.  
Estudiantes de enfermería.

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## INTRODUCTION

Cardiac Arrest (CA) is the main cause of death in Europe <sup>(1)</sup>, the United States of America (USA) and Canada <sup>(2)</sup>. In Brazil, diseases of the circulatory system are the main cause of death (32%), followed by external causes (15%) and tumors (15%) <sup>(3)</sup>.

On the other hand, trauma is an increasingly significant health problem all over the world, since nearly 16,000 people die every day due to wounds, and thousands have permanent sequelae <sup>(4)</sup>. If we consider only the age range from 01 to 40 years, trauma represents the main cause of death, striking individuals in their most productive phase and inflicting irreversible social damage <sup>(5)</sup>.

In view of this panorama, several Nursing school curricula offer contents related to Basic Life Support (BLS) and Advanced Life Support (ALS). However, our experience tells us that most nurses do not feel effective capable of working in emergency situations, especially in Cardiopulmonary Arrest (CPA) cases.

Thus, what is missing in the Cardiopulmonary Resuscitation teaching-learning process? How should students be involved in this process in order to feel effectively capable of acting in a real situation?

Educator should start from the students' personal and direct experiences and give them something *to do*, not something *to learn*. This is the only way in which the educator will place students *in action so that they can reflect about the relations involved in the study object*. Therefore, students should be placed in the face of *problems... not simulated or ridiculous problems* but, overall, *real problems* that would propel them to action <sup>(6)</sup>.

Several authors <sup>(7-11)</sup> have developed studies about problematizing methodologies. Among them, Problematization and Problem-Based Learning (PBL) are two distinct proposals that *intentionally work with problems to develop the learning and teaching processes* <sup>(7)</sup>.

Both Problematization and PBL break away from the traditional teaching and learning, making the students learn through doubting, reflexively questioning and allowing them to build their own knowledge. These methodologies encourage the participative management of the protagonists of the experience and the reorganization of the relation between theory and practice, but they have different potentials in terms of conception and education <sup>(10)</sup>.

In **Problematization**, problems are extracted from reality through observations performed by the students. Charles Maguerez' Arch Method represents the first reference for this method, being made up of distinct stages, linked from a problem detected in reality. Reality is problematized by the students, without restrictions regarding as-

pects included in the formulation of problems, since these are extracted from the social reality, itself dynamic and complex <sup>(7-8)</sup>.

Conversely, in **Problem-Based Learning**, students deal with previously elaborated problems. Usually, small groups are formed, supervised by a tutor. Problems are often a phenomenon or an event (such as a clinical situation or problem) to be analyzed by the group, using the previous knowledge of the actors involved. From that point, students attempt to understand the subjacent processes, which results in questions. These questions represent one of the learning goals and will serve as a starting point for individual and collective studies <sup>(11)</sup>.

A closer look at PBL reveals that its origins lie in the *principles of the Active School of the Scientific Method*, and an *Integrating Education, integrator of contents*, where students, regardless of their study cycles and the different areas involved, learn how to learn and prepare themselves to solve problems related to their future profession <sup>(7)</sup>.

PBL, in the scope of Medical education, had its origin in the mid-1960s at McMaster University (Canada). Further experiences were developed in the University of New Mexico (USA) and Maastricht University (The Netherlands) <sup>(11)</sup>. In Brazil, several PBL-based studies have been developed in the health-care area <sup>(9-11)</sup>. However, the number of experiences in the Nursing area remains small.

According to McMaster University <sup>(12)</sup>, Problem-Based Learning should follow a sequence of stages: *Presenting the problem® Identifying what should be learned® Learning® Applying*.

In view of these considerations, the **objective** of this study was to: Develop a Problem-Based Cardiopulmonary Resuscitation / Basic Life Support educational practice with the students of the undergraduate Nursing course at a university in the South of Brazil.

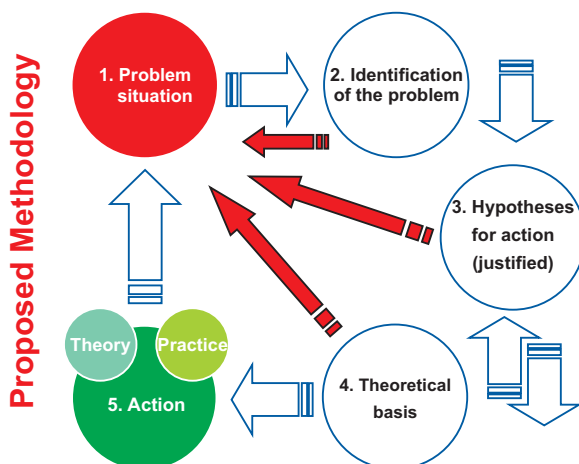
## METHOD

This is a descriptive, exploratory study, developed at the end of 2006, involving 24 students of the 3<sup>rd</sup> phase of the undergraduate Nursing course. The inclusion criteria were: accepting to participate in this study freely and spontaneously by signing a term of consent, and being a regular student of the 3<sup>rd</sup> stage of the undergraduate Nursing course at that university.

The study is in accordance with Resolution 196/96, which establishes Guidelines and Standards for research involving human beings. It was approved by the Ethics Committee of the University where the research was performed (Project #279/2006).

The educational practice was developed in five encounters (each lasting three hours), structured as follows: **First Encounter** – presentation of the subjects involved, objectives, contents and proposed method: presentation of a Cardiopulmonary Arrest problem situation in an adult; and structuring the PCR content in BLS from this situation onwards. **Second Encounter**: practice of the different BLS stages on a specific dummy; release of an airway obstruction problem situation to be analyzed in groups. **Third Encounter** – reviewing the contents addressed in the previous encounters through educational games; construction of the BLS algorithm, in groups; and discussion about three new problem situations (drowning, electric shock and poisoning by gas). **Fourth encounter** – developing competences for the initial provision of healthcare to the trauma victim, by simulating a motorcycle accident. **Fifth Encounter** – evaluating the students' capacity of acting in real situations; and evaluating the educational practice and method used.

In order to make our proposal feasible, each encounter was methodologically based on the constructivist referential and on PBL (Figure 1)



**Figure 1** – Methodology serving as the base for each encounter– Florianópolis – 2006

The methodological strategies for data collection used during the encounters were: participative observation; two structured questionnaires for learning assessment (Individual activities 1 and 2); and one questionnaire to evaluate the educational practice and its methodology<sup>(13)</sup>.

Descriptive statistics were used to process and analyze the quantitative data (central tendency and data dispersion measurements). Bibliographic references and their support on Problem-Based Learning were used to analyze the qualitative variables related with the students' participation and their learning performance.

## RESULTS

In order to facilitate the comprehension of the dynamics of this proposal, we chose to describe the results by grouping them according to the following strategies: Students' expectancies regarding the educational practice; group activities; individual activities; practical activities; evaluation of the encounters and their methodology.

### Students' expectancies regarding the educational practice

In the first encounter, when asked about their goals and expectancies about the proposal, the group mentioned that this was *an interesting theme [...] for healthcare professionals [...] and even for laypeople*, and they expected to be able to *learn the basics* to be able to *act, know what to do*, in case it is necessary, *without fear and without getting in the way*. Their testimonies show that they did not feel qualified to act effectively in BLS, but they were motivated to build a solid knowledge base in the CPR area.

### Group activities

One of the learning strategies was the execution of two in-person group activities. Therefore, the students formed five groups with four or five elements each, attempting to respond to a problem presented by the educator.

**Group activity 1** (executed in the second encounter) confronted the students with a problem situation of partial airway obstruction, which evolved towards a situation of total airway obstruction:

Mrs. RP, 76 years old, loves to take walks with her husband in the Barigüi Park (in Curitiba). One day, while enjoying an ice-cream cone, Mrs. RP choked on a fragment of the cone, starting to cough compulsively, bringing her hands to her throat and presenting highly teary eyes [...] what action should be taken in this case? [...] In spite of all efforts to remove the cone fragment, Mrs. RP starts to become cyanotic, with cold skin, and suddenly loses consciousness. What should be done in this situation?

Previously selected theoretical materials were handed out by the groups, so that each group would formulate hypotheses for the situation presented. Later, the different groups had opportunities to discuss their ideas, with discussions about converging and diverging aspects and exchanging of ideas being observed, as well as the clarification of doubts, among others. Eventually, the contents discussed and practical training were synthesized through simulations and on specific dummies, with the goal of inter-relating theory with practice.

**Group activity 2** (executed in the third encounter) consisted of building the BLS algorithm in cardiology, using the knowledge acquired in the previous encounters. Each group was provided with a strip of brown paper to build the BLS algorithm. Each group participated actively in this activity,

and all groups had the opportunity to learn from their colleagues' work. Next, the collective construction of the algorithm took place, where the main stages were compiled and doubts were clarified, always using errors as opportunities for learning.

These group activities were shown to be good strategies for the educational practice, since students had the opportunity to express their opinion within small groups (without the need to expose oneself in front of the whole group) and made intra- and inter-group discussions possible, where the educator played the part of mediator of discussions and learning itself.

### Individual activities

Parallel to the group activities, the studies had the opportunity to perform individual activities, answering

two specific questionnaires named Individual Activity 1 and 2.

**Individual Activity 1** was executed at the end of the first encounter, with the presentation of a CRA problem situation in an adult. The students were intended to answer a 14-question questionnaire (10 multiple-choice questions and 4 with short answers) about the different stages of Basic Life Support in Cardiology.

The students' score in this activity ranged from 0 (zero) to 100 (one hundred), with the results presented in Figure 2. The group's average score was 90.14, with a standard deviation of 8.94. Hence, this group had very homogenous scores. Student #3 had the maximum score of 100 and Student 15 had the lowest score, 64.29 (minimum), revealing some difficulties for BLS service in Cardiology. Student #16 was the only one not to do Individual Activity 1.

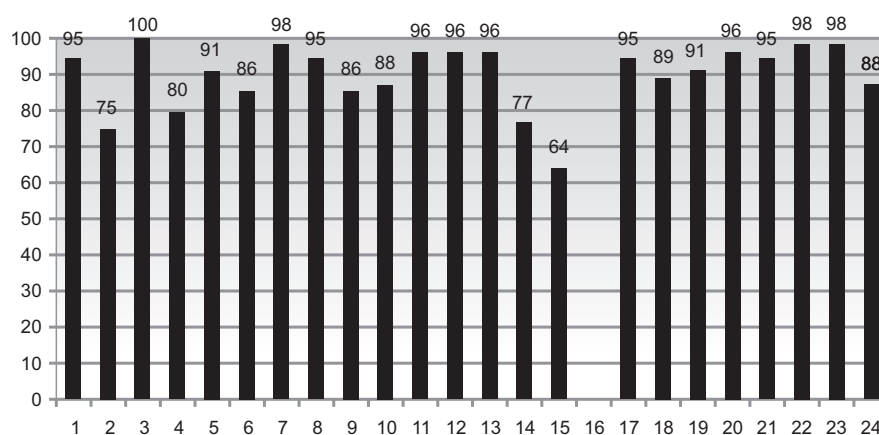


Figure 2 – Scores obtained by the students in Individual Activity 1 – Florianópolis – 2006

**Individual Activity 2**, executed during the fourth encounter, aimed at completing the algorithm for Basic Life Support actions, including special situations of Cardiorespiratory Arrest and trauma situations. The students' score in this activity also ranged from 0 (zero) to 100 (one hundred), with the results presented in Figure 3.

The group's average score was 82.71, with a standard deviation of 13.83. Therefore, the average group score was reduced, and the standard deviation increased in relation to Individual Activity 1. Student #22 had the maximum score of 100, while two students had less positive results (Students #14 and #15, scoring 40 and 45, respectively), revealing learning difficulties when compared with the rest of the group.

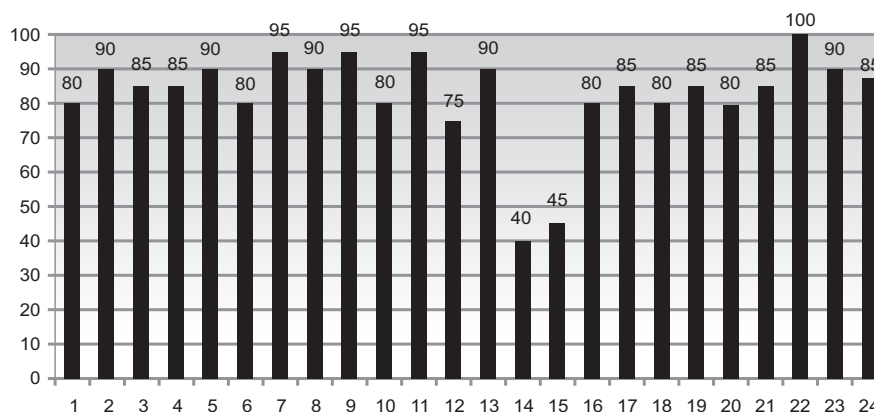


Figure 3 – Scores obtained by the students in Individual Activity 2 – Florianópolis – 2006



Comparing both activities, a reduced average group score was observed, along with a higher score dispersion, probably due to the increasing complexity of the proposed activity. Qualitatively, a certain difficulty is highlighted in the students regarding decision-making, i.e. describing which interventions they would perform at the very beginning of Basic Life Support care.

### Practical activity

In the last encounter, the students, distributed in randomly-assigned pairs, were confronted with simulated CRA situations in specific dummies. During their work, some situations were identified as deserving our reflection:

- Difficulties in establishing a plan of action in view of the presented situation, difficulty to define roles and priorities to provide BLS;
- The *American Heart Association* guidelines<sup>(2)</sup> recommend every healthcare professional to assess effective signs of breathing and circulation for 10 seconds. In spite of the emphasis placed during the whole educational practice, it was observed that the students did not spend enough time for this evaluation, which can be translated as low reliability in CRA identification when faced with a real situation;
- Difficulties to open the airways through hyperextension of the head and elevation of the chin (in situations that did not involve a risk of trauma), thus jeopardizing the ventilation effectiveness.
- Confronting the student with a (simulated) problem situation allowed us to have a better perception of their capacity to act in a real situation, detecting more difficult or fragile aspects.

### Evaluation of the meetings and methodology used

At the start of each meeting, the students could evaluate their performance in the previous encounter, with the following positive aspects being mentioned: *the learning dynamics, dynamic evaluation, practice on specific dummies, the relationship between theory and practice, and the collective construction of learning*, especially through group work and the synthesis performed. The negative aspects

identified were: *problems with material, overloading with academic activities, excessive time for reviewing the content of the previous encounters*.

In the last encounter, each student had the opportunity to evaluate the educational practice as a whole, as well as the methodology used, according to the following items: Content (Figure 4); Goals (Figure 5); Learning activities (Figure 6); Evaluation (Figure 7); Performance of the educator (Figure 8); and Material utilized (Figure 9). The scores established for each evaluative item were, respectively, *very good, good, average and poor*.

The charts presented were structured according to relative frequencies (shown on the vertical axis) and the respective evaluative items (horizontal axis)

On Figure 4, it can be observed that 10 students (41.67%) classified the content structure as very good, 11 (45.83%) as good and 3 (12.5%) as average. We believe the less positive classifications are related with a negative aspect the students mentioned: *excessive time for reviewing the content of the previous encounters*.

Regarding the comprehensiveness of the content, 8 students (33.33%) rated it as very good, 14 (58.33%) as good, 1 (4.17%) as average and 1 (4.17%) as poor. The adequacy of the contents to the students' needs received 11 (45.83%) very good evaluations, 12 (50%) students classified it as good and only 1 (4.17%) as average. The analysis of these two topics makes it evident that the group wishes to broaden the range of learning contents, addressing themes like *first aid, burns and bandaging*. However, the general objective of this proposal consisted in creating a solid knowledge base to work with CPR/BLS effectively.

Regarding the emphasis placed on the contents, 18 students (75%) rated them as very good and 6 (25%) as good. These data highlight the importance of planning educational activities in order to (in spite of using active teaching-learning methodologies) avoid losing the central focus of the proposal.

And finally, regarding the teacher's mastery of the content, 22 students rated it as very good, 1 (4.17%) as good and 1 (4.17%) as average.

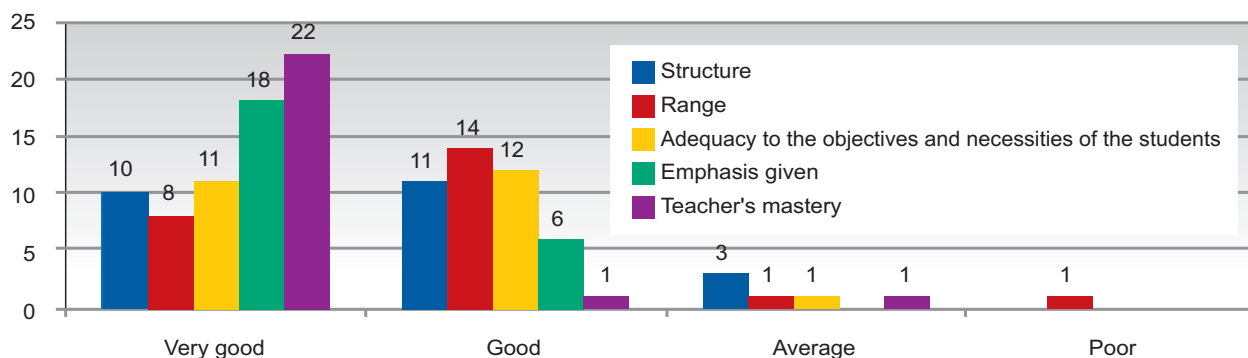


Figure 4 – Students' evaluation of the contents – Florianópolis – 2006

Figure 5 shows the students' evaluation of the goals. Regarding the adequacy of the general goals, 13 students (54.17%) rated it as very good, 10 (41.67%) as good and 1 (4.17%) as average. As for meeting these goals, 8 students (33.33%) classified it as very good and 16 (66.67%) as

good. Once more, the necessity of planning our educational practices becomes evident, in order to provide effective responses to the goals of practice itself and the individual necessities and goals of each student.

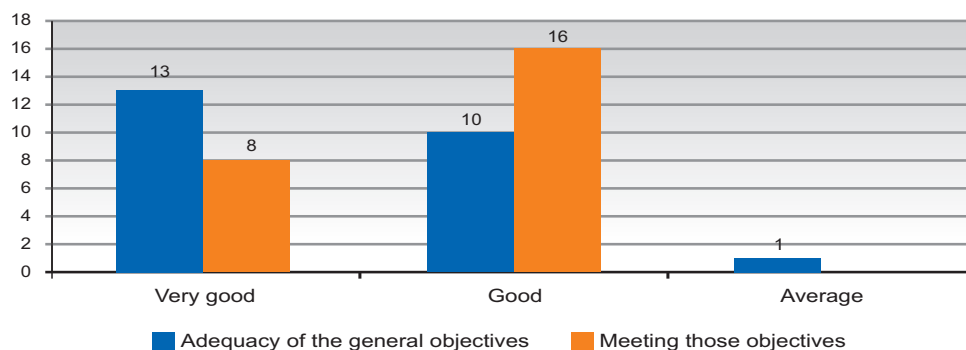


Figure 5 – Students' evaluation of the goals – Florianópolis – 2006

Figure 6 shows the students' ratings of the learning activities.

Regarding the adequacy of the objectives, the content and the group, 15 students (62.5%) rated it as very good, 8 (33.33%) as good and only 1 (4.17%) did not answer. As for variety, 11 students (45.83%) classified it

as very good, 8 (33.33%) as good and 5 (20.83%) as average, reinforcing the students' desire to widen the range of contents.

As for the adequacy of these activities by the teacher, 15 students (62.5%) classify it as very good, 8 (33.33%) as good and 1 (4.17%) as average.

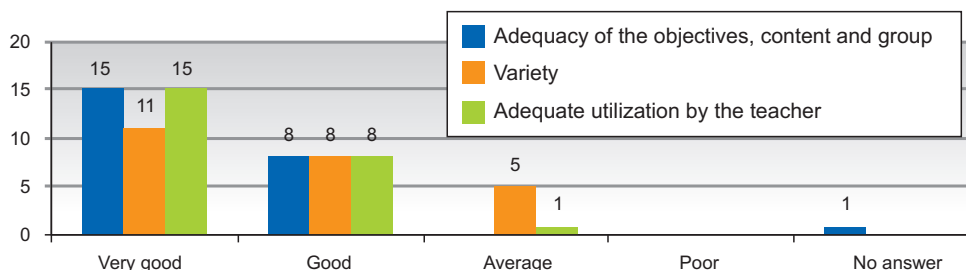


Figure 6 – Students' evaluation of the learning activities – Florianópolis – 2006

Figure 7 shows the students' rating of the demands related with the training activities, with 8 students (33.33%) rating it as good, 11 (45.83%) as good, 4 (16.67%) as average and 1 (4.17%) did not answer. These data allow us to

reflect about our attitude as educators. It is true that active methodologies break away from the traditional forms of teaching and learning<sup>(10)</sup>. However, we must not be careless with the demands in the evaluative processes.

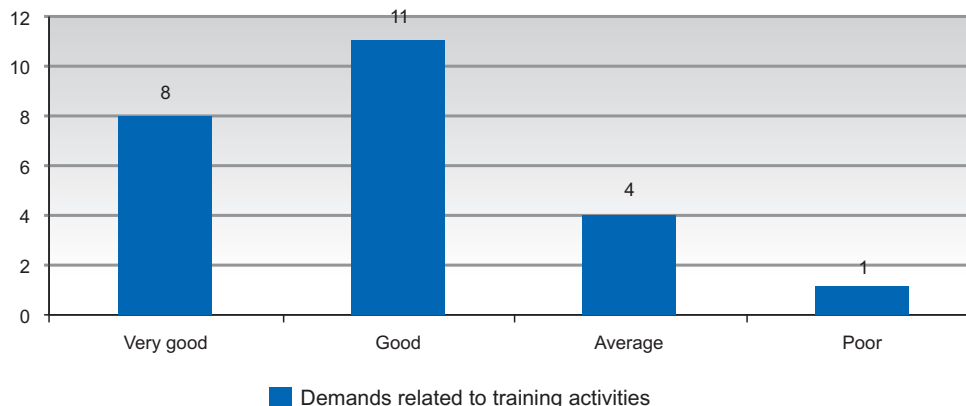


Figure 7 – Student's opinions about the evaluation – Florianópolis – 2006

Figure 8 shows the evaluation in relation to the performance of the teacher, with 16 students (66.67%) rating their rapport with the teacher as very good, 6 (25%) as good and 2 (8.33%) as average. Regarding attention given to individual necessities, 13 students (54.17%) rated it as very good, 10 (41.67%) as good and 1 (4.17%) as average. With respect to the teacher's competence, 20 students (83.33%) classified it as very good, 3 (12.5%) as good and only 1 (4.17%) did not answer. As for the dedication and interest of the teacher, 22 students (91.67%) considered it very good and only 2 (8.33%) good. These results are very encouraging, since they value the work developed collectively and the energies used to plan and structure the whole practice.

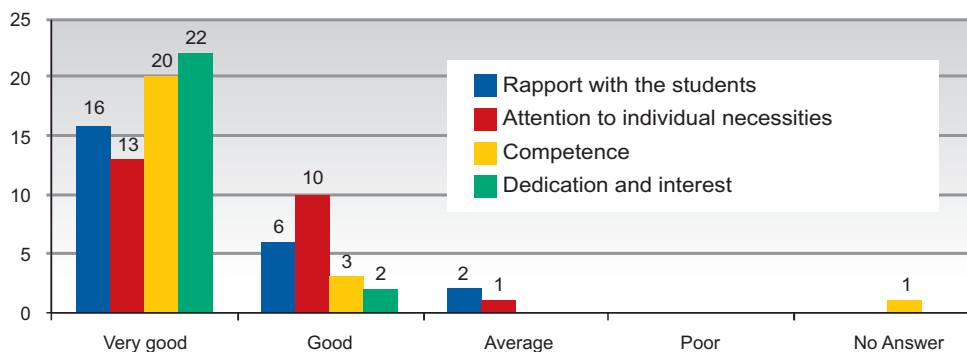


Figure 8 – Students' evaluation of the teacher's performance – Florianópolis – 2006

Figure 9 shows the students' ratings on the quality of the material used. Only 1 student (4.17%) rated the material offered by the university as very good, 12 (50%) as good, 9 (37.5%) as average and 2 (8.33%) as poor. These data express that the University under study needs to acquire specific material to develop this type of educational practice.

As for the educational material available, only 4 students (16.67%) rated it as very good, with 15 (62.5%) considering it good, 4 (16.67%) average and 1 (4.17%) poor. Effectively, the University library does not have an up-to-date selection in this area, and the material available on the Internet with the latest guidelines is only presented in English. Therefore, most of the material was selected and/or produced by the organizers of the educational practice.

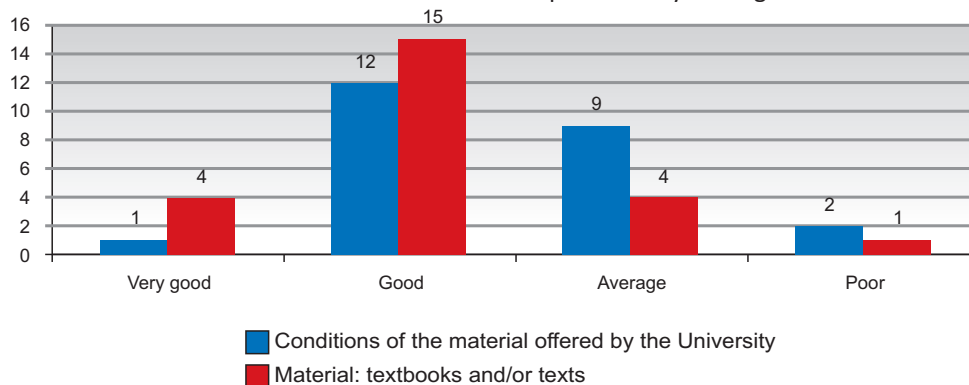


Figure 9 – Students' evaluation about the quality of the material utilized – Florianópolis – 2006

## FINAL CONSIDERATIONS

Although we noticed that the students were deeply rooted in the traditional educational processes, we believe that this educational practice of Problem-Based Learning in CPR/BLS encouraged them to take an active part in the construction of their own knowledge. The presentation of Cardiorespiratory Arrest *problem situations* in places the students know and can be found at increased their motivation to learn to act efficiently in BLS, and challenged them to make decisions and take action.

By reflecting on the results of planning and implementing this educational practice, we conclude that:

- The construction of a student-centered educational practice, with the student as the learning subject and supported by the educator, as a facilitator and mediator of the teaching-learning process, represents an attractive alternative to move the educational focus from *What to teach* towards *what to learn*;

- An educational practice that is methodologically supported by constructivist references and Problem-Based Learning, allows us to monitor the individual and collective



growth of the students, detect their learning difficulties early and create strategies to minimize them;

- The group activities and the discussion among different groups represent an adequate teaching-learning strategy, since each person has the opportunity to learn from the other;

- The utilization of images and the exemplification on specific dummies contributed to "materialize" the contents being discussed;

- The practical activities developed from the simulation of a Cardiopulmonary Arrest allowed for the identification and correction of the main difficulties for action in Basic Life support.

- The PBL methodology developed and applied in this study allows the educator to evaluate the learning process of the student in several dimensions, bringing it closer to the many moments they experience.

- Still, it is worth noting that the active methodology of Problem-Based Learning works as a motivating factor for the educator as well as for the student because, among other aspects, it permits the encounter with practical realities.

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We know that the introduction of innovative teaching methodologies is a slow process. However, undergraduate students want to be active participants in this process, growing from mere receivers of knowledge to become constructors of their own education <sup>(14)</sup>.

Indeed, the students feel that they must be the protagonists of their learning, attempting to build their own knowledge. It is therefore the duty of the teachers to play the part of *mediators of this process, supporting, helping, challenging, provoking and encouraging the construction of knowledge*<sup>(15)</sup>.

Therefore, this PBL practice in CPR, besides encouraging the Nursing students to take a more active role in their learning process, allowed them to start building a solid knowledge base in BLS that will enable them to work in line with the current demands of global reference protocols and that can motivate them to learn contents of higher complexity (in the emergency area). In this context, PBL is a strategy that goes beyond the traditional educational practices, involving teachers and students in an integrated learning process.