Education 2013, 3(3): 161-167
DOI: 10.5923/j.edu.20130303.04

Public School versus Private School: An Interdisciplinary Perception of Students Regarding the Teaching of Sciences and Physical Education

Jacir Vicente Weber[1,*], Ana de Souza Lima[1], Felix Alexandre Soares[1,2,*], João Batista Teixeira Rocha[1,2]

[1]Graduate Program in Science Education: Chemistry of Life and Health - CCNE - UFSM
[2]Departmentof Chemistry - CCNE - UFSM

Abstract The present study examined the perspective of Middleand High school students from private and public schools regardingthe existence of interdisciplinary in the contents of Sciences and Physical Education. The research subjects included 1830 studentsfrom junior high (6th, 7th and 8th grades) and high school (1st, 2nd and 3rd grades in the Brazilian educational system), of which 1030 studied in public schools and 800 in private schools, in Santa Maria (RS – Brazil), aged between 10 and 18 years old.In conclusion, the findings show that in both public and private education, students agree that there is an interdisciplinary relationship between the subjects of Sciences and Physical Education in their school and also present that the private school teaching is focused on getting students approved in tenders, especially in "Vestibular" (Brazilian Universities admission exam), while public teaching is focused in a globalized education.

Keywords Interdisciplinarity,Sciences,Physical Education, Public School, Private School

1. Context

In Brazil, interdisciplinarity has been the subject of studies and researches in the field of education since the early 70s, and it has aroused a need for the design of new paradigms of science and knowledge as well as the development of new projects for education, schools and life[1]. Literature[2] points out that the principle of interdisciplinarity tries to articulate, interact and integrate multiple school subjects. In recent years, interdisciplinarity has been adopted by educational policies as a pedagogical solution for the problems that go along with the process of teaching and learning, with the challenge of establishing new interactions among disciplines. However, it can be observed that its use "has become a fad and a strong currencyin the educational field," mainly to justify curriculum proposals which are said to be innovative, conferring “greater legitimacy to such discourses"[3]. According toFreire[4], interdisciplinarityis the methodological process of one’s knowledge construction based with the relation to one’s context, reality and culture, in which the conception of ainterdisciplinary work presupposes a procedure that comes from the idea that several sciences should contribute to the study of certain themes, which could guide all the school work.The ideal for Education, in general, would be to discover a new organizer core around which different disciplines would be linked. According to Coelho[5], currently, educational training seeks interactionbetween certain fields of knowledge, so that one can contribute to the otherstowards the acquisition of knowledge. In order to do so, it is essential that Science students become aware of the applicability of what they learn in school. Such applicability, however, often comes down to problem solving - the student learns a particular concept to apply in the proposed tasks.On other occasions, students are led to apply what is learned in school to previous scientific "findings" or "achievements" that are distant from their life experiences. Literature data[6]indicates that most researchers in Science Teaching agree that we need to overcome the school traditional manner of knowledge transmission, by offering basic education in order to train students to understand scientific activities, and approaching the nature of Sciences and of scientific practice. Thus, the teaching of Science should provide the students the opportunity to interpret different situations of everyday life with the use of scientific and technological knowledge, it should also give them the ability to use their knowledge to understand real life situations and, if necessary, to put it into practice[7].

For the teaching of Sciences in Middle school, the “PCNs”[8], which are the Brazilian national curriculum parameters, established that the discipline seeks the

* Corresponding author:
weberjacir@gmail.com (Jacir Vicente Weber)
felix@ufsm.br (Felix Alexandre Soares)
Published online at http://journal.sapub.org/edu

understanding of citizenship as a collective practice of political, civil and social rights and duties. Consequently, the student is not only a citizen of the future, but is already acitizen today, therefore, knowing Sciences means to increase their social participation and mental development, enabling the exercise of citizenship.While the"PCNEM"[9], which are the Brazilian national curriculum parameters for High schools, proposes a general formation instead of a specific, developing the skill to research, seek, analyse and select information and alsothe ability to learn, create and formulate, rather than a simple memorization exercise. In this context,the interdisciplinary view of Physical Education,to[10], is important to relateits contents to other subjects, existing of the body with the mind, where the knowledge cannot be unattached, but only united, complementing each other

The Physical Education, in the understanding of the author, needs other subjects to aid the students learning process but without mischaracterizing its praxis, since it has specific contents to be taught in schools, as wellas other existing disciplines. However,[11] argues for a proposition, in which the process of teaching and learning is part of the school education proposal, where the teaching of Physical Education should join the school project, working in partnership with other curricular subjects to achieve a common goal – the training of students.

The "PCNs"[8] emphasize, to the teaching of Physical Education, the importance of the relationship between learning how to do something, knowing why you are doing it and how to relate to it, highlighting the dimensions of procedural, conceptual and attitudinal contents, respectively. Furthermore, it proposes an interaction between Physical Education activities and the major problems of the Brazilian society, but without losing sight of its role to integrate the citizen in the area of corporal culture, through the principles that determine transversal themes. In High school Physical Education classes often repeat programs from the Middle school, and are limited to the basic practice of some sports and the execution of specific sport techniques, so as a result, students do not consider Physical Education a relevant subject.

When the profiles of public and private schools are mapped, many different aspects are found, including: students' relationship, teachers' educational level, the structure of the schools, the quality of education, and job prospects for the future, and these aspects affect which type of school and education parents will choose for their children[12].

In public schools, according to[13],, the numbers of dropoutsand failing students are a great concern and it gets worse each year. Literature[14] reports that apparently there are no initiatives to improve education, due to the complacency present in public schools. Education should form critical thinking citizens with the ability to reflect. It should also encourage, guide and stimulate professional vocations, consolidation knowledge and preparing individual to work and exercise citizenship, so that the students learn more and more.

Regarding public education, parents are greatly disappointed since they are aware that the teaching quality is not good enough to ensure future professional success, but even so, parents and schools do not seem to question the teachers. Likewise, labs, libraries, sports facilities are poorly structured and many schools don't even have them. Classes have too many students and the school environment is not a safe place for them. Moreover, most of the teachers, who are underpaid, take up roles of psychologists, social workers, doctors and even of parents, when they tryto help students with the different problems they face every day in the public schools. With an educational perspective focused for life, public school students will face more difficulties when applyingto entera University[14]. In private schools, the main mission is to offer the best education, with no marketing appeal, according to which they would beforming the "best student", where the teacher works along with students in order to make them responsible citizens. The existence of private schools is supported by the Brazilian Constitution that, in the chapter regarding education, foresees the freedom to teach and learn, as well as "the pluralism of ideas and educational concepts and the coexistence of public and private institutions"[15]. Moreover, in private schools, there is the pressure of parents who pay tuition and want to see good results in the school and inthe Universityadmission exam, even when the school intends to present a broad, humanistic education, enabling students to engage more in educational projects and being encouraged to be more creative, dynamic and organized when carrying out tasks, providing access to laboratories, libraries and gyms, among other advantages. Albuquerque and collaborators[14] also add that, in private schools, the quality of teachers, the availability of technical resources, the organization and the level of students influence the teachingperformance; the quality of the teacher depends on theireducation, which is a result of academic background, motivation and attendance, and these features together constitute a determinantfactor for students in their performance in the University admission exam.

The present study aimed to conduct a comparison between the interdisciplinary perspective of Middle schooland Highschool students from public and private schools on the teaching of Sciences and Physical Education. The study is justified by the perception of a great inequalitythat exists between the public and private schools regarding how students are prepared to take the"Vestibular" (Brazilian University admissionexam), taking into account their experience in Middle and High school. According to[14], private schools are increasingly focused on preparing their students to be approved in the "Vestibular", unlike public schools that focus on the overall training of students to become good citizens. In this scenario, the issues related to the topic of interdisciplinary, expressed by the "PCNs"[8], proposethat Physical Education and

Sciences should merge, and that emerging social issues should be included on a daily school basis, in order to contribute to students' learning, to the citizen's thinking and critical training, giving them the opportunity to question the outlines and contents presented by teachers in the classrooms.

2. Methodology

The study was conducted in eight schools in the urban region of Santa Maria, Rio Grande do Sul, Brazil - four public and four private Middle and High schools. The total number of students participating was 1830, males and females. The ages of the students ranged from 10 to 18 years old. The criteria used to include the students in the study were that they had to voluntarily agree to participate, and be in the 6th, 7th or 8th grades or in the 1st, 2nd or 3rd year of High school. The questionnaires were applied in 2009 and 2010, in private and public schools, respectively.

Aiming to examine the perspective of students about the interdisciplinary of the contents applied in Sciences and Physical Education in public and private schools, an open question was answered by the students individually and anonymously, all they had to inform was their school grade, gender and age, on the sheet header.

The question given to the students was as follows:

Do you believe that there is a relationship between the disciplines of Physical Education (physical activity) and Sciences (Chemistry, Biology and Physics) in the contents taught in school? Yes or no - justifying the reasons.

The methodology of this study was quali-quantitative bias. For data interpretation and categorization of responses by subject, we adopted content analysis, according to the propositions of[16], which deals with the unveiling of meanings of different types of speeches, based on inference or deduction, but that simultaneously enables specific criteria regarding data rate in thematic structures, among others.

The study was developed in two parts:

The first part was the application of questionnaires to the students.Then the categorization of these answers was conducted, aiming to identify pertinent themes in order to group them in categories. Then qualitative analyses of answers were performed.The categories emerged from the analysis of students' responses. Five categories were created for the affirmative answers, and were called "A" (Answers related to Chemical reactions), "B" (Answers related to the subjects of Physical Education and subjects such as Chemistry, Physics and Biology); “C” (Answers related to aspects of physiology); “D” (Answers presenting interdisciplinarity between Science and Physical Education) and “E” (Answers out of context). For the negative answers, three categories were created - "A" (Answers that present dichotomy between body and mind, with no interdisciplinary relationship among the contents); “B” (Negative answers with no explanation) and “C” (Explanations out of context).

After this we performed a second analysis when the categories were grouped through the quantitative analysis of the students’ answers, from Middle and High, public and private schools, as is shown in the tables.

The project was approved by the Committee of Ethics and Research of the Federal University of Santa Maria (RS – Brazil), under CAAE No 0053.1.243.000-88.

3. Results and Discussion

Results obtained using the following question: Do you believe that there is a relationship between the disciplines of Physical Education (physical activity) and Science (Chemistry, Biology and Physics) in the contents taught in school? Yes or no - justify the reasons.

The total number of 1030 Middle school students (6th, 7th and 8th grade) and High school students (1st, 2nd and 3rd grade) from public schools answered this question, being: 438 male, 511 female and 81 unidentified. As for private schools the total number of students who responded to the question was 800 students, as follows: 261 male, 283 female and 256 unidentified.

Table 1 shows the distribution of students from public and private schools separated by Middle Schoolgrades (6th, 7th and 8th grades) and High school grades (1st, 2nd and 3rd grades). Moreover, it also shows the total number of 1030 students for public and 800 students for private education, presented separated by gender and unidentified.

Table 1. Total Comparison of Public and Private Education X Grade

	Public Education			Private Education		
Grade	Male	Female	Unid	Male	Female	Unid
6th	28.7	54.6	16.7	27.7	31.5	40.8
7th	34.2	51.7	14.1	30.8	33.8	35.4
8th	37.6	54.6	7.8	28.6	35.6	35.8
1st	45.7	47.5	6.8	46.3	33.3	20.4
2nd	46.2	48.9	4.9	36.7	35.2	28.1
3rd	49.5	45.6	4.9	25.2	42.1	32.7

The data presented in Table 1 enables the view of the distribution of students in Middle and High education for public and private schools.

Table 2 highlights the percentage of public and private schools for Middle and Highschool students’ responses, in relation to their perspective on interdisciplinarity on the disciplines of Science and Physical Education. For affirmative answers, the percentage of Middle schoolsfor public and private education, are around 50%. And for High schools, percentages were 74.6% in public and 59.2% in private.For negative answers, there was a growth of 41.5% in the Middle school forpublic education, 33.3% in private schools and in High schoolsfor public schools a decrease of 20.5% was found, and decrease to 15.2% in private schools and even percentages for unidentified.

Table 2. Total Comparison of Public and Private Education X Interdisciplinarity

	Public Education			Private Education		
Teaching	Yes	No	Unid	Yes	No	Unid
Middle	49.9	41.5	8.7	51.1	33.3	15.6
High	74.6	20.5	4.9	59.2	15.2	25.6

The answers regarding the existence of interdisciplinarity among what is taught in public and private Middle schools shown in Table 2, practically remained at the same level, in the range of 50% to both. As for the answers of public high schools (74.6%) compared to private schools (59.2%), there is a percentage difference of approximately 15% on the students' perspective of interdisciplinarity. This may have occurred due to the proximity of the date of "Vestibular", considering that froma practical point of view, students are believed to understand the teaching of Science as something important, mainly because it is included in the "Vestibular" and students have to "use their heads" to learn Science, while Physical Education may be just considered physical activity and they have to "use their body," according to examples of their answers in the survey. Literature[14], in studies regardingteaching in public and private schools, claimed that private schools meet the entire content scheduled for the year, but their greater focus is to the approval of their students on "Vestibular".

Concerningthe public and private school students' perspective of interdisciplinary, both had a growth percentage from the Middleto Highschool. This interdisciplinary approach can be noted in the examples given asanswers to the question of the existence of interdisciplinary between Physical Education and Science, as a student affirms: "Everything we study in Science, we use in Physical Education and vice-versa, they explain each other, they are related". Or in this student reply: "Exercising alters the body's metabolism (Biology), producing energy (Chemistry) with movements (Physics)."

Nowadays, interdisciplinarity through educational training, looks for certain fields of knowledge, so that one discipline can contribute to the other in order to acquire common knowledge[5].

Table 3. Total Comparison of Public and Private Education X Junior High and Senior High and Affirmative Answer Categories Only questions answered (100%)

	Public Education		Private Education	
Categories	Middle	High	Middle	High
Category A	42.16	23.16	21.52	20.3
Category B	10.66	36.02	33.28	37.57
Category C	14.16	13.27	24.49	10.23
Category D	16.06	14.33	9.31	14.1
Category E	16.96	13.22	11.4	17.8

The analysis of the data presented on Table 3 as the percentage change in each category of affirmative answers, in each level of education, brought up the following results: in the publicMiddle schools, the category with the highest number of answers was "A" with 42.16%, decreasingin private school to 21.52% (answers related to Chemical reactions), and, in the High school results were equivalent - from 20% to 23%, respectively. The "B" category had its highest percentage in private Middle schools, reaching 33.28% against 10.66% in public schools (answers related to the subjects of Physical Education and subjects such as Chemistry, Physics and Biology), leaving High schoolsin 37% in both the public and private educationThe "C" category decreased its percentage of 24.49% in private Middle schools to 14.16% in public schools (answers related to aspects of Physiology), reaching a mean of 12% in the Middle schools. Regarding the "D" category (answers presenting interdisciplinarity between Science and Physical Education) and the "E" category (answers out of context) had, respectively, percentages, for Middle school, varying on a mean of 12% and 13% for High school, both for public and private education.

The categories were formed according to examples provided in the answersevaluating the existence of an interdisciplinary relationship.

Examples of answers to the "A" category

Answers related to chemical reactions.

Public Education – seventh-grader: Chemical reaction happens when we exercise. And High school student: Exercises cause chemical reactions in the individual.

Private Education –Sixth-grader - When exercising, the body undergoes several chemical reactions. And High school student - When we exercise, we are at the same time going through all kinds of chemical reactions.

Examples of answers to the "B" category

Answers related to the subjects of Physical Education and subjects such as Chemistry, Physics and Biology.

Public Education – Eighth-grader: In Physical Education when we run there is energy loss and that is biology. And a High school student answered: When we practice physical exercises, things change in our bodies such as our metabolism (Biology), positions (Physical) and energy production (Chemistry).

Private Education –Seventh-grader - Science studies the functioning of body movements. And a High school student- When we exercise, science is happening.

Examples of answers to the "C" category

Answers related to aspects of physiology

Public Education – Eighth-grader: A healthy body has strength, energy and a long life. And a High school studentanswered: Our body is made up of muscles, blood and cells that give us energy to live.

Private Education– Seventh-grader - Everything is related to metabolism, endurance, strength, and body cells. And a high school student - Everything is related to the body, muscles, movement, and acceleration.

Examples of answers to the "D" category

Answers presenting interdisciplinarity between Science and Physical Education

Public Education – seventh-grader: The subjects of Science are applied in Physical Education. And from a High school student: Everything we study in Science, we use in

Physical Education and vice-versa, one explains the other, and they are related.

Private Education– Eighth-grader - In physical activity, we exercise, the movement is Physics, we spend energy, it is the chemical and biological processes, it is physical conditioning. And a High school studentanswered - We study at school in the disciplines of Physics, the movements, in Chemistry, reactions, and in Biology, the cells.

Examples of answers to the "E" category: Answers out of context.

Public Education – Sixth-grader: We have to study to be healthy. And a High school studentanswered: Both subjects are taught in our school.

Private Education– Eighth-grader - Exercising does improve our thoughts. And a High school studentanswered - Physical activity decreases our concerns, it soothes the mind.

Table 3 shows, for the affirmative answers and that interdisciplinary between Science and Physical Education is believed to exist, category "A" that deals "with answers related to chemical reactions" in public Middle school with a percentage of 42.16%. What draws attention - and that could be a starting point to try to articulate the "contents" - is the question of the high occurrence of answers related to aspects of chemical reactions. In fact, this could be an approach to be considered in the Sciences, as a way to better understand the phenomena studied within the disciplines of Chemistry and Physical Education. According the “PCNs"[8], Science Education should contribute to the understanding of the world and collaborate with the training of citizens, where the possibility of using specific knowledge to understand and, if necessary, act in several situations of life must be considered when selecting the content and approach of Science in Middle school education. In order for this to happen, within an interdisciplinary view, it is necessary that students understand the applicability of what they learn in school, it is essential that everyday situations are put in question and not just used as a form of motivation[7].

Within this context, category "B" had three times more "answers that relate the discipline of Physical Education to the contents of Chemistry, Physics and Biology" and presented a percentage of 10.66% for public Middle schools and 33.28% for private schools. Such difference in percentage may be due to possible gaps in the curriculum of Middle schools (6th, 7th and 8th grades) in public schools, because they have in their curriculum, science subjects covering contents in the area of biological sciences in particular the human body. Private junior high schools (6th and 7th grades) also have the content of Biological Sciences (human body), but eighth-graders start to see contents in the areas of Chemistry, Physics and Biology, separately, with each discipline focusing on a different specific content. They also have specific teachers for each subject, and sometimes the same teacher is in charge of the three disciplines, facilitating interdisciplinary among the content taught in the different areas. Such distinction in the curriculum is explicitly supported in the “PCNs”[8], which highlights the legal provisions that establish the curricular flexibility and the role of schools in the collective construction of their educational proposals “PCNs”[8]. The autonomy of the educational proposals of school systems and units to contextualize the curriculum according to regional characteristics, locations, and the lives of their students is supported by the “PCNEM”[9]. Therefore, the fact that the students have had classes on the disciplines of Chemistry, Physics and Biology separately may have facilitated their interdisciplinary understanding in Middle school private education, in the shaping of student thinking and the development of students' responses, as it can be observed in the responses, the role of Physical Education and Science acquiring the function of facilitating instrument when, in practice, demonstrates the concrete meaning, intent and applicability of content acquired in the theory of the class.

Table 4, which addresses the difference in the percentages of negative answers category, in each grade, showed the following results: The private Middle school in the "A" category (answers that present dichotomy between body and mind, with no relationship between interdisciplinary contents) had the largest difference in percentage compared to the public Middle schools, where 41.2% was found for private and 29.4% for public Middle schools, as well as in High schools, 70.22% versus 27.1%, respectively. In the "B" category ("no" answers with no explanation) the private Middle schoolshowed a percentage of 37.65% and 22.37% for public and furthermore, the High schoolwas approximately 15% for both. The "C" category (justification of answers out of context) in Middle school, had a percentage of 48.23% for public education and 21.15% for private, and yet, in High school, the public presented apercentage of 54% and 19.4% for the private..

Table 4. Total Comparison of Public and Private Education X Junior High and Senior High and Negative Answer Categories Only questions answered (100%)

	Public Education		Private Education	
Categories	Middle	High	Middle	High
Category A	29.40	27.10	41.2	70.22
Category B	22.37	18.18	37.65	10.13
Category C	48.23	54.72	21.15	19.65

According to the example answers, that formed the categories, considering interdisciplinary relationship "not" to exist.

Examples of answers to the "A" category

Answers that present dichotomy between body and mind, with no interdisciplinary relationship among the contents:

Public Education – Sixth-grader: Science is the study of cells and Physical Education is sports. And a High school student answered: Physical Education is the practice and Science is the theory.

Private Education– Sixth-grader - In Physical activity, we practice sports and in Science we have the contents. And a High school student answered - Physical activity is the practice of physical exercises and Science is theory.

Examples of answers to the "B" category

"No" answers with no explanation.

Public Education – Seventh-grader: No, and that's it. And a High school student: No, just no.

Private Education– Eighth-grader - I don't know. And a High school student answered - No.

Examples of answers to the "C" category:

Explanations out of the context.

Public Education – Sixth-grader: Teachers don't know how to teach a class and it is complicated for students. And a High school student answered: I don't know why we have so many subjects; we don't need half of them.

Private Education –Sixth-grader – The student should take only the subjects they wanted to take. And a High school student answered – We should have the option of going to Physical Education or not.

On table 4 , the study analysis for negative answers to have interdisciplinary relation have shown the perspective of public Middleand High schoolstudents inregard to the "C" category (the explanation of answers was out of context) with an equal number of students' answers, with a mean of 50% for both levels of education. The pattern of student answers unrelated to the topic, points out some possibilities: students are not interested in elaborating their ideas about the proposed topic; the contents taught in class are out of the interdisciplinary context, so students cannot relate matters of Science and Physical Education and there could be a problem with the question itself.

According to Santos[17], it is essential to rethink work methodology in order to take the student from the passive and dependent condition, whose main activities are repetition and copying, and turn them into acting individuals in their learning processes, by using teaching strategies that will require them to search for information, to elaborate and continuously rebuild knowledge. In school planning, especially in regard to the objectives of each discipline or field of study, expressions related to the idea of making students more active and creative are commonly used, however, parents and teachers, public opinion leaders, have been insisting on excessive passivity and even the alienation of children and teenagers. Hardly ever we see discussions that address creativity, as well as who will benefit from it and how you can contribute with it, or what such creativity will bring as far as good consequences[18].

As for the negative answers of private High school students the "A" category (Answers that present dichotomy between body and mind, with no interdisciplinary relationship among the contents) reached its highest percentage of 70.22%. What draws attention is the increasing dichotomy between body (physical education) and mind (science) as they go from Middleto High school. It becomes clear that private High school students, when focused on "Vestibular", they representa considerable growth in the dichotomy between the two areas. This may occur because students from private schools are more encouraged to fight for jobs and enter higher education. In Brazilian schools, the teaching in public schools is completely different than in private schools. Literature[19], who have examined the performance of Brazilian students in the University admission exam, the authors concluded in their studies that the performance of public school students on the exam is, on average, 17.7% lower than private school students.

In public school, teaching methods have evolved considerably in recent years, for example, the use of everyday life instruments in the classroom cooperates with student learning in achieving good results to enter the university and to their lives. In private schools, they comply with all content scheduled for the year, but their main focus is to have students approved in the "Vestibular"[14]. Such a fact could potentially create false expectations to a greater chance of being approved in "Vestibular", if students have more time to study instead of practicing exercises, which according to them is a "waste of time".

4. Conclusions

The analysis of this study on the potential existence of interdisciplinary knowledge between the disciplines of Physical Education and Science, by examining the speech of Middle and High school students, have resulted in some considerations. Results found show that around 74.6% in public schools and 59.2% in private schools, high school students believe that there is interdisciplinary relationship between Science and Physical Education. However, it should be noted that although the students indicate the existence of some kind of relationship between these disciplines, their explanations for the answers are very shallow. Thus, referring to an analysis of "PCNs"[8], which claims that Physical Education and Science should merge and that emerging social issues should be included and discussed daily at school, seeking for an educational purpose to meet the demands of its complexity and dynamics in order to contribute to learning, to the training of citizens that are able to criticize and question the methodologies and contents used in class "PCNs"[8]. Thus, it would be possible to find more specific and direct answers for the questions made.

Results of the affirmative answers of High school students pointing to the existence of interdisciplinarity, both in public and in private schools, show that the need for an interaction of Physical Education with other disciplines is important and necessary. Accordingly, for[20], Physical Education becomes the tool that enables easy learning, when, in practice, and it is able to show the real applicability of the theoretical content taught in the classroom. In other words, the child, while playing, can be encouraged to conduct counts, compare quantities, identify numerals, add points, understand about numeric intervals and start learning the content related to cognitive arithmetic.

For Salvador[21], the interdisciplinary approach should point to the thematization of the elements of the culture of movement and Science, in order to develop among students the ability to analyse and critically act in the teaching field, and that would thus improve their quality of life, since it would give them guidance to build a global background.

Teaching should currently have as main objective to encourage students so they can explore a variety of ideas, stimulating their curiosity and developing different ways of perceiving and understanding the world where they live.

ACKNOWLEDGEMENTS

This study was supported by CNPq, CAPES, FAPERGS/PRONEX. J.B.T.R. and F.A.S. are recipient of scientific fellowship from CNPQ-PQ.

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