REFLEXÃO E AÇÃO

ARTIGO

Polytechnic Curriculum Units as Pedagogical Innovation: Integrating Chemistry and Physical Education in High School

UNIDADES CURRICULARES POLITÉCNICAS COMO INOVAÇÃO PEDAGÓGICA: INTEGRANDO QUÍMICA E EDUCAÇÃO FÍSICA NO ENSINO MÉDIO

UNIDADES CURRICULARES POLITÉCNICAS COMO INNOVACIÓN PEDAGÓGICA: INTEGRANDO QUÍMICA Y EDUCACIÓN FÍSICA EN LA EDUCACIÓN MEDIA

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ABSTRACT

This study presents a Polytechnic Curriculum Unit (PCU) that integrates Chemistry and Physical Education, highlighting the potential of contextualized and interdisciplinary teaching. PCUs are curriculum components designed collaboratively by multiple disciplines, aligned with polytechnic core objectives and the contents of basic and technological areas. The methodology followed a qualitative action-research approach, with joint teaching activities over three months. Topics addressed included anabolic steroids, energy drinks, hepatotoxicity from weight loss supplements, thermogenics, and dietary products. These themes were explored from both chemical and physical education perspectives, promoting meaningful learning through real-life contexts. The experience fostered integration between scientific investigation, innovation, sociocultural mediation, and entrepreneurship—pillars of the polytechnic approach. Results demonstrate that PCUs can transcend traditional curricular boundaries by encouraging articulation among knowledge areas and providing a more dynamic and relevant educational experience.

Keywords: Interdisciplinarity; Active Methodologies; Integrated High School.

RESUMO

Este estudo apresenta uma Unidade Curricular Politécnica (UCP) que integra os componentes de Química e Educação Física, evidenciando o potencial do ensino contextualizado e interdisciplinar. As UCPs constituem componentes curriculares elaborados de forma colaborativa por diferentes áreas do conhecimento, alinhados aos objetivos centrais da formação politécnica e aos conteúdos das áreas básica e tecnológica. A metodologia adotada seguiu uma abordagem qualitativa de pesquisa-ação, com atividades docentes conjuntas desenvolvidas ao longo de três meses. Foram abordados temas como anabolizantes, bebidas energéticas, hepatotoxicidade por suplementos para emagrecimento, termogênicos e produtos dietéticos. Esses conteúdos foram explorados sob as perspectivas da Química e da Educação Física, promovendo uma aprendizagem significativa a partir de contextos reais. A experiência favoreceu a integração entre investigação científica, inovação, mediação sociocultural e empreendedorismo — pilares da formação politécnica. Os resultados demonstram que as UCPs podem ultrapassar os limites curriculares tradicionais, promovendo articulação entre áreas e uma formação mais dinâmica e relevante.

Palavras-chave: Interdisciplinaridade; Metodologias ativas; Ensino Médio Integrado.

RESUMEN

Este estudio presenta una Unidad Curricular Politécnica (UCP) que integra los componentes de Química y Educación Física, evidenciando el potencial de la enseñanza contextualizada e interdisciplinaria. Las UCP constituyen componentes curriculares elaborados de manera colaborativa por diferentes áreas del conocimiento, alineados con los objetivos centrales de la formación politécnica y con los contenidos de las áreas básicas y tecnológicas. La metodología adoptada siguió un enfoque cualitativo de investigación-acción, con actividades docentes conjuntas desarrolladas a lo largo de tres meses. Se abordaron temas como anabólicos, bebidas energéticas, hepatotoxicidad por suplementos para adelgazar, termogénicos y productos dietéticos. Estos contenidos fueron explorados desde las perspectivas de la Química y de la Educación Física, promoviendo un aprendizaje significativo a partir de contextos reales. La experiencia favoreció la integración entre investigación científica, innovación, mediación sociocultural y emprendimiento, pilares de la formación politécnica. Los resultados demuestran que las

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UCP pueden superar los límites curriculares tradicionales, promoviendo la articulación entre áreas y una formación más dinámica y relevante.
Palabras clave: Interdisciplinariedad; Metodologías activas; Educación Media Integrada.

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INTRODUCTION

New educational demands, which have deeply changed relations among the market, workforce and production, have emerged in the Brazilian scenario in this century. Several changes have reflected on Education and require responses to adapt the educational complex to new teaching needs. Both competence pedagogy and "pedagogy of learning how to learn" emerged in the light of the new demands (Araújo; Iwasse, 2019). This social context exerts strong influence on the conception of interdisciplinarity – highlighted by current Education – developed as a response to changes resulting from the sphere of production, politics and culture. However, formulations around interdisciplinarity are not unambiguous since they have different epistemological, ontological and axiological origins. In fact, rapid growth of scientific knowledge and the paradox of its expansion and specialization has made educators reflect and resume possibilities of interdisciplinarity as a response to consequent fragmentation of knowledge and science nowadays (Souza et al., 2016).

When school curriculum is constructed in an interdisciplinary way, it seems to abandon close structures of every discipline and its concepts to encourage students to work on a final common project or product, based on a supposed consensus which often disguises dominance relations of some knowledge over the others and even class conflicts found in schools. Thus, every work group should clearly know the concepts *multidisciplinary*, *interdisciplinary* and *transdisciplinary*. The axis of relations among members of a multidisciplinary team is vertical since strength of every person and every discipline is the core of the relation between people and knowledge. The interdisciplinary team is based on horizontal relations, i. e., nobody is above anybody else and emphasis is given to knowledge sharing, even though autonomy of every knowledge, its method and its procedures, is kept. The transdisciplinary conception of science focuses on concrete reality, the process, the movement of the real and history. Knowledge is seen from a transversal perspective in which methodological fundamentals that are common to several disciplines converge to produce new knowledge and new science (Fernandes; Gomes, 2022).

The use of the new teaching methodology named Polytechnic Curriculum Unit (PCU) at the Instituto Federal do Triângulo Mineiro (IFTM) - *Campus* Uberlândia Centro is based on the need and obligation to integrate different areas of knowledge. This teaching strategy opposes old methods of knowledge fragmentation. The literature reports that knowledge fragmentation leads to separation among school disciplines and becomes harmful to Education. The result of knowledge fragmentation is loss of meaning, which makes students repudiate certain disciplines, a fact that shows that they cannot perceive similarities and relations among distinct areas of knowledge (Gerhard; Filho, 2012).

Based on these thoughts and definitions, this study originated from the following question: "How can Chemistry and Physical Education (P.E.) intertwine and be transformed into a proposal for a PCU?". Joining two disciplines is a great challenge since many conservative teachers, who prefer to teach their contents separately, may be against it. The great challenge refers specifically to the issue of Integrated High School and the theme of interdisciplinarity, even though the current literature has emphasized the concept of integration. The whole concept considers three fundamental principles of curriculum integration: the subject as a historical being; social totality, including science, politics, culture and economy; and the method that aims at capturing objective relations of reality, which starts from the empirical concept and goes beyond it, considering that the theory is the real raised to level of thought (Morais et al., 2022).

Current and modern Chemistry teaching is based on constructivist and investigative ways not only to qualify methodologies applied by teachers but also to help students understand the real meaning of Chemistry by using problematization. This methodology is based on investigative factors that promote development of teaching as a whole in the area of Sciences of Nature, instead of Chemistry teaching alone. It enables improvement of several skills that contribute to teaching and learning processes since it may be used as a guided action which makes students experience situations that are able to trigger their interest, need and pleasure of scientific discovery (Passos et al., 2023).

From the perspective of P.E. teaching, there are uncountable possibilities of enriching students' lives and ensure learning construction so that they may develop and broaden their autonomy to use the body culture of movement in different situations and enable their confident and involvement in society. After all, "P.E. is the curriculum component that thematizes body practices in their distinct ways of codification and social significance which are seen as manifestations of people's possibilities of expression and cultural heritage of humanity" (Moreira et al., 2017).

In this new integrative methodological conception, this study was guided by the theme *interdisciplinary teaching*, in which Chemistry and P.E. worked together. It aimed at showing that two areas of knowledge may work together satisfactorily, i. e., together in class, two teachers of different disciplines may mutually contribute to learning and teaching processes. In addition, it should be highlighted that this study results from the need and obligation to implement the new method of work – PCU – in all grades in the Integrated High School at the IFTM - *Campus* Uberlândia Centro.

THEORETICAL FRAMEWORKS TIME AND SPACE IN CURRICULUM ORGANIZATION

The dynamics of curriculum organization in contemporaneous schools reflects a historical trajectory under the strong influence of narratives that were developed in modern times since its first phase mainly in the areas of Science, Politics and Economy. Besides, because both categories time and space lie in the basis of curriculum organization in schools, they are founding elements of the dynamics that guides their routine. Re-definition of organization processes of curriculum and pedagogical activities in the light of current conceptions of time and space may significantly offer students opportunities to learn and develop. Finally, when curriculum dynamics is discussed, both categories are usually treated inextricably, i. e., that are seen as parts of a process that merges into school reality dialectically (Thiesen, 2011).

Curriculum organization of courses aims at constructing an effectively integrated teaching curriculum in which the so-called technical knowledge and common bases converge to overcome social challenges of work, coexistence, citizenship, technology and environment. This set of requirements have originated PCUs and shown that real integration does not result from the mere mixture of contents of disciplines that form both basic and polytechnic cores.

BASIC, TECHNICAL AND POLYTECHNIC CORES

Firstly, in the Federal Network of Professional, Scientific, and Technological Education in Brazil, technical education is offered in three modalities: subsequent, concomitant, and integrated with high school. The integrated modality is designed to articulate general secondary education with technical and professional training within a unified curriculum. Although this model is often associated with full-time education, its implementation varies according to the

institutional autonomy of each Federal Institute. Therefore, integrated programs may be offered in a full-day schedule, on selected full days, or even in a single daily shift, depending on the specific curricular organization of each Campus. This modality is guided by the educational principle of work and the pedagogical principle of research (Nitschke; Plácido; Pitt, 2021).

Integrated teaching is composed of at least three main cores: the technical, basic and polytechnic ones. The technical core is responsible for aggregating curriculum components and professionals that work in the specific technical area of the course. The basic core groups curriculum components – propaedeutic ones – and their respective teachers. The common polytechnic core conciliates curriculum knowledge and professionals of both previous cores in an integrated, interdisciplinary and dialogic way (Belchior; Silva, 2020).

The basic core comprises curriculum units that deal with knowledge and skills that are inherent to basic Education. It is essentially based on knowledge and skills in the areas of languages and their codes, Human Sciences, Mathematics and Sciences of Nature which aim at developing logic reasoning, argumentation, reflective capacities and intellectual autonomy, thus, contributing to develop subjects that think and interact with all concepts (Ferretti et al., 2018).

The polytechnic core implies the combination of school and work, i. e., of intellectual instruction and productive work, which considers "polytechnics" the Education that enables comprehension of scientific-technological and historical principles of modern production to guide students to carry out multiple choices (Oliveira; Machado, 2012).

Therefore, combination of the cores proposes the development of PCUs to reach consistent and integrated Education effectively, considering not only needs of both technical and basic areas but also needs of the main actors in the process: students.

WHAT IS THE POLYTECHNIC CURRICULUM UNIT (PCU)?

Resolution no. 135 of the IFTM issued on December 16th, 2020, established that the PCU is a curriculum component designed by different areas of knowledge based on objectives of the Polytechnic Core and on contents found in syllabuses of components of both basic and technological cores. In order to promote real integration, curriculum units of the polytechnic core are constructed in and interdisciplinary, transdisciplinary and multiage way and integrate different courses since challenges of integration may be solved by the variety of curriculum organizations that better respond to the heterogeneity of students and the environment. It implies "curriculum, time and space flexibility" and includes several possibilities, such as the open use

of the diversified part of the curriculum, optional studies and “non-disciplinary” activities, free groupings of students who attend different grades and years, interdisciplinary and transdisciplinary projects and activities that enable initiative, autonomy and protagonism and incorporation of intraschool and extraschool times and spaces.

Therefore, to enable curriculum integration in this core, this study proposes a flexible curriculum model, in which students have the opportunity to choose what to study, based on their interest and needs, in the light of the desired curriculum profile. PCUs that constitute this core are planned by different areas of knowledge from an interdisciplinary and transdisciplinary perspective. PCUs integrate students that attend different grades and courses and breaks the sequence structure that is usually employed by “disciplines”. It also enables students with different maturity levels to participate, since they are driven by their own interests in the topic.

WHAT ARE THE MEANINGS OF INTERDISCIPLINARITY AND TRANSDISCIPLINARITY IN EDUCATION?

Interdisciplinarity is a concept that refers to the bonding process between two or among more disciplines, based on something they have in common. As a result, interdisciplinarity proposes dialogue among all Sciences so that knowledge is understood as a whole, instead of fragmented parts. It considers dialogue among disciplines but keeps being structured on spheres of disciplinarity (Silva; Cusati; Guerra, 2018).

A step further is the idea of transdisciplinarity, which means that there are no more boundaries among disciplines and other sources and levels of knowledge are considered. Transdisciplinarity is an approach that aims at bringing knowledge together and articulating elements that intertwine disciplines in the search for comprehension of the complexity of the real world. In transdisciplinarity, there is intercommunication among disciplines and no boundaries among them. It searches for maximum interaction among disciplines and, simultaneously, respects their singularities, since every discipline collaborates for common and complete knowledge, but does not transform them into a single discipline. The idea of transdisciplinarity emerged from the need to overcome the concept of discipline which is characterized by departmentalization of knowledge in several subjects and every discipline is addressed in a fragmented and isolated way. Transdisciplinarity does not merely mean that disciplines cooperate with each other but that there is an organizing thought which goes beyond the disciplines themselves. To enable transdisciplinarity, an organizing thought – the so-called complex thought

– is needed. The real problem is not to add knowledge but to organize the whole knowledge (Silva; Cusati; Guerra, 2018).

Interdisciplinarity and transdisciplinarity do not imply elimination of disciplines but a way to make them establish a dialogue, bonds of convergence, complementarity and interconnection of knowledge. Interdisciplinarity is characterized by both intensity of exchanges among experts and real integration among disciplines towards mutual research projects. Its concept does not exclude the idea of disciplines; on the contrary, it reinforces that an interdisciplinary study may only succeed "when several disciplines intertwine, based on a mutual object". Interdisciplinarity is certainly much more than putting disciplines together: "it is a new view on possibilities of relations among them and fundamental issues of contemporaneity" (Silva; Cusati; Guerra, 2018).

Finally, both interdisciplinarity and transdisciplinarity carry the idea of thinking about knowledge as a net, which means that knowledge is considered in an integrated and systemic context, in a complex reality in which everything is interconnected. It brings meaningful implication to the idea of society, which must also be considered a net, i. e., a complex image, an integrated and systemic context constituted by many elements (knots) and relations among them, instead of individualism, mere aggregation of independent individuals.

INTERDISCIPLINARITY BETWEEN CHEMISTRY AND P.E.: WHAT IS IN THE LITERATURE?

Interdisciplinarity among Chemistry and P.E. has been poorly reported by scientific papers published in Portuguese. Texts found in the Brazilian literature were abstracts of presentations in congresses in Brazil. This study highlights findings in the Brazilian literature and discusses two papers that address the possibility of integration between Chemistry and P.E..

The first study shows that different methodologies favor interaction among distinct disciplines associated with students' sociocultural reality and may lead to their commitment to school activities, stimulate their autonomy and enable quality learning. Therefore, interdisciplinarity is viable to establish the relation between Chemistry and P.E. By using qualitative action-research, the authors discussed the themes *body*, *food intake*, *dietary supplementation* and *anabolic steroids* with 29 High School juniors at the Instituto Federal de Educação, Ciência e Tecnologia do Rio Grande do Norte, in Natal, RN, Brazil, and showed that it was promising to both teaching and learning processes (Maia; Bizerra, 2021). Addressing

contents related to biological, cultural and social aspects of the body, mainly its relation to food intake, dietary supplementation and anabolic steroids, is extremely important in schools since it enables students to discuss the themes as part of the curriculum in educational and informative ways and to reflect on them collectively. As a result, the use of an interdisciplinary practice which intertwines knowledge of Chemistry and P.E. may characterize successful work because it introduces knowledge broadly and impacts students' learning and personal lives positively (Maia; Bizerra, 2021).

Regarding Chemistry, another study shows the possibility of working on Electrochemistry with the support of P.E. in High School. In their proposal of interdisciplinarity, the authors used chemical indoors soccer to teach about batteries. Results showed that the complexity of Electrochemistry was mitigated by experiments and a physical activity and that students were able to understand chemical concepts in a fun way. Thus, the task contributed to develop critical citizens with a comprehensive view of Chemistry (Yamaguchi; Silva, 2020).

METHODOLOGY

This section shows the trajectory of this study and reports all its steps. It comprises discussions about the type of study, the target audience, data collection tools, development of the intervention and generating themes used for the analysis.

Concerning the type of study, it is an exploratory and explanatory one which evaluates the possibility of some satisfactory work to establish certain criteria and appropriate methods and techniques (Guerra et al., 2023). The explanatory nature applies to this study because this proposal aims at recording and analyzing the impact of an interdisciplinary intervention on students' learning in detail (Guerra et al., 2023). The exploratory study is the preparation for the explanatory one. Therefore, this choice was made because they complement each other. Besides, the qualitative approach should be considered since no focus is given to the quantitative one. Qualitative studies do not concern with numerical representation, i. e., they neither employ statistical tools to analyze problems nor aim at measuring and listing categories. They show concern for real aspects that cannot be quantified and focus on explanation and understanding of social relations (Guerra et al., 2023).

Among types of qualitative studies, action-research was chosen because it is attractive to the area of Education, mainly because it involves and helps teachers to reflect on situations that they experience in Education. Action-research is the type of social research that has close association with an action or resolution of a collective problem which involves researchers and

participants who represent the situation to be investigated in collaborative and participatory ways. Thus, "action-research also has the advantage of breaking traditional power relations between researchers and participants. It mitigates the 'technocratic' risk and authoritarianism of scientific discourse that intends to be above other knowledge" (Silva; Oliveira; Ataídes, 2021).

This study fits into previously mentioned methodologies. In addition, the 3-month intervention that was carried out with the students enabled teachers to experience several pedagogical alternatives which involved the following generating themes: Chemistry of anabolic steroids, anabolic steroids in sports, energy drinks, hepatotoxicity induced by weight loss supplements (herbal and dietary ones), risks posed by weight loss drugs, thermogenics and dietary supplements.

RESULTS AND DISCUSSION

Integration was the starting point to develop the interdisciplinary proposal. The beginning was the conversation between both Chemistry and P.E. teachers who were able to talk, reflect and design an action plan. The plan and the selection of contents to be taught led to the PCU named "Dialogue between Chemistry and P.E.".

All contents chosen to be taught integratively in the PCU were based on students' previous curiosity, shown in traditional Chemistry and P.E. classes. As a result, the following themes were selected: Chemistry of anabolic steroids, anabolic steroids in sports, energy drinks, hepatotoxicity induced by weight loss supplements (herbal and dietary ones), risks posed by weight loss drugs, thermogenics and dietary supplements. These themes, which are related to "social construction of the body and its relation to chemical and biological aspects, health and well-being", guided the PCU.

To know the body, anatomical, physiological, biomechanical and biochemical knowledge is addressed to enable critical analysis of physical activity programs and determination of criteria of judgment, choice and execution of healthy body activities. Biochemistry may contribute with contents that underpin Physiology: some metabolic processes of energy production, elimination and restitution of basic nutrients (Santos et al., 2021). Therefore, there is knowledge that may be developed in both P.E. and Chemistry, which may involve concepts related to lipids, carbohydrates, proteins and their relations to the body.

Both Chemistry and P.E. teachers considered integration on three fundamental pillars: from the perspectives of teachers, students and knowledge itself. After the development of the

initial proposal of integration, which aimed at listing contents of the disciplines, both teachers had to face some difficulties. It should be mentioned that there are difficulties regarding integration in all areas of knowledge and that they get stronger when two or more disciplines attempt to work together. Both Chemistry and P.E. teachers said that it is hard to plan a PCU due to the need for more time to study another area and considered it complex and challenging.

Interdisciplinarity is complex and challenging indeed. The literature reports that it is also a necessary practice to overcome fragmented knowledge and that it must be implemented in schools. Interdisciplinary thought is characterized by the capacity of going beyond boundaries of disciplines, i. e., of solving problems by integrating knowledge constructed by two or more disciplines so as to promote cognitive advance which would not be reached by a single discipline. This type of thought leads to the development of critical thinking, capacity of intertwining disciplines, use of metacognitive skills and application of advanced epistemological assumptions (Shaw, 2018).

PCUs were implemented at the IFTM - *Campus* Uberlândia Centro and made available to all Integrated High School students in 2020. Teachers started to face the challenge of working together, i. e., three teachers per PCU. After some time, every PCU comprised two teachers. As a result, more PCUs were offered to students who could choose the topics that interested them. Both teachers who planned a PCU determined the number of vacancies (from 20 to 30) so that students could sign up. Teachers also decide if their PCUs last 3 months, a semester or a school year. A curious fact is that students look forward to signing up for PCUs which often have their vacancies taken in minutes. They say that their choices are based on: (1) attractive theme; (2) light content that needs little effort; (3) contents that are part of the ENEM; and (4) favorite teachers.

It should be highlighted that PCUs have innovated teaching at the IFTM. For instance, a PCU named *Mathematics and citizenship* may address contents of exponential and logarithm functions which are taught in Math. In addition, it may deepen concepts of Financial Math and Information Technology to interpret and construct models of family budget control, simulate interest calculations (simple and compound ones) to help everyday decision making. Thus, PCUs must be planned to address a scientific issue as a theme with an introduction, development and closure. This curriculum organization enables better integration between basic and professional areas since it involves participation of different areas by means of a multilateral dialogue in which problems and needs are constantly introduced.

In contrast with the traditional system of disciplines, contents and objectives that are taught in different grades and belong to their mandatory syllabus may be used to construct a PCU. It considers not only interests of professional and basic areas but also teachers' and students' participation to establish a healthy dialogic relation in the process of knowledge construction.

Integration between Chemistry and P.E. in the PCU was successful and students approved their teachers' work. Both teachers did their best to consider how relevant selected contents were to students' lives and to their school trajectory. Besides, they aimed at content contextualization and flexible treatment to make it meaningful to the heterogenous group. The chosen themes integrate concepts from both Chemistry and Physical Education to provide a multidisciplinary approach.

One of the explored topics is the *chemistry of anabolic steroids*, which involves *Organic Chemistry*, including *the structural formulas of organic compounds, identification of functional groups, and mechanisms of action* (from *Biochemistry*). In the context of Physical Education, the topic addresses *what anabolic steroids are, the harm caused by unsupervised use, who uses them and why, and their role as ergogenic resources*, especially focusing on *pharmaceutical applications*.

Regarding *the use of anabolic steroids in sports*, Chemistry contributes through *analytical methods for detecting these compounds in blood*, with emphasis on *chromatography*. In Physical Education, this theme connects with *the relationship between anabolic steroid use, physical activity, and sports performance*, as well as *the risks of indiscriminate usage*.

When analyzing *hepatotoxicity associated with herbal and dietary supplements*, Chemistry emphasizes the *identification of active ingredients present in products sold at drugstores and natural product shops*. Physical Education addresses *the definition of dietary supplementation, its role as a nutritional ergogenic resource, and a critical view on popular brands that promise unrealistic results*.

The topic of *risks posed by weight loss drugs* includes a Chemistry perspective that highlights the *chemical structures of the main active ingredients found in weight loss products on the market*. From the Physical Education viewpoint, it involves *the importance of regular physical activity for maintaining a healthy body, the use of medication in the fight against obesity, and the calculation of Body Mass Index (BMI)*.

In the discussion about *energy drinks and their consumption by children and adolescents*, Chemistry contributes by examining *sugar as a drug and the presence of caffeine, taurine, and other chemical substances in various energy drink brands*, along with *measurement units such*

as grams and milligrams. Physical Education focuses on *the link between these beverages and obesity, health issues in younger populations, and the biochemical impact these drinks have on the human body*.

The topic of *thermogenics and their effects on the body* brings in Chemistry content about *the meaning of compounds that induce the body to produce more heat, along with the concepts of heat and temperature*. In Physical Education, the theme includes *the role of intense physical activity in triggering thermogenesis, and a practical session on calculating calories burned through activities like running or walking*.

Finally, in the theme of *dietary supplements*, Chemistry contributes with *the structural formulas of amino acids, the distinction between essential and non-essential amino acids, and the process of protein formation*, distinguishing between *protein-based and carbohydrate-based supplements*. From the Physical Education perspective, it highlights *the importance of healthy eating, how physical activity influences macronutrient needs, and the daily nutritional demands associated with active lifestyles*.

Points that both disciplines had in common enabled to reach areas called flexible boundaries which led to interdependence, sharing, meeting, dialogue and transformation. Lessons enabled communication of different contents and that, in the end, common contents between both disciplines became bridges. However, it should be mentioned that information that constructs the bridge is important so that students are capable of searching for knowledge beyond both areas. Therefore, contents developed by both Chemistry and P.E. teachers became an important tool in the relation and learning that permeate the areas.

Considering the method that emphasizes connection among disciplines, teaching shows that putting knowledge together is essential to construct quality Education. As a result, students become critical and innovative citizens in their society. The literature reports that interdisciplinary work only happens in plans since many projects that aim at unifying certain subject in different disciplines are not successful and do not lead to knowledge globalization (Silva, 2019).

In short, educators have to detach themselves from traditionalism and dare in their practices and studies because a new pedagogical attitude leads to positive changes in Education. PCUs that have been developed at the IFTM ensure that different areas of knowledge may be intertwined. Its teachers took up the idea and made it happen. Thus, interdisciplinarity is an innovative reality at the IFTM nowadays.

CONCLUSION

This study showed the need to overcome the fragmentary nature of different areas of knowledge and to search for curriculum integration that enables knowledge under construction to become more meaningful to students and to favor their active participation by means of skills, life experiences and distinct interests. The PCU "*Dialogue between Chemistry and P.E.*" led to positive impacts on students' learning. Contents were broadened, deepened and better contextualized as the result of the interdisciplinary work that was carried out. Regarding Chemistry and P.E. teachers, this study was very important to their professional improvement in Basic, Technical and Technological Education (BTTE) since it posed many pedagogical challenges to both teachers who had never worked in an interdisciplinary way.

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