ORIGINAL ARTICLE

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ABSTRACT

Chemistry teaching is not such an easy task for teachers trained in contemporary times. The process of updating your resume should be a constant in the profession. The teacher needs to plan his classes with a language that can make it easier for the student to understand the contents explained. One of the ways of working with chemistry could be with the student actively participating in the process. Agrochemicals are feasible topics to be mediated in this way and can potentially increase students' interest in the discipline. This article aims to identify the strategies for teaching chemistry at a high professional and technological level present in scientific articles with the theme "pesticides". The methodology chosen for this study was a qualitative approach centered on being concerned with reality. The observation

of this brief survey allows us to conclude that the teaching of chemistry in high school groups can and must be related to the area of research and scientific dissemination; there are several didactic tools that enable more assertive ways related to teaching chemistry; and relating the content of chemistry to interdisciplinary and specific subjects, such as pesticides, can help a better understanding of the content of chemistry in high school students.

Keywords: High school, Chemistry, EPT, Agrochemicals.

INTRODUCTION

Mediating the teaching of Chemistry is not such an easy task for teachers trained in contemporary times, as Salgado, Passos and Ribeiro (2018) confirm that having chemical knowledge is not enough to guarantee success in the teaching-learning process, in the consensus that teaching it requires study, planning, patience. Zabala (1998 apud Salgado *et al.* (2018) affirms that concepts cannot be learned if we cannot understand the meaning of what is being built at that moment. In consensus, teaching must guarantee meaningful learning for the student, thus enabling the construction of their own concepts.

In this perspective for (Ribeiro *et al.*, 2020) the teacher must be prepared for the constant changes in the educational scenario. In this sense, the process of updating your curriculum should be a constant in the teaching profession. It is worth mentioning that this knowledge must be worked on in the classroom, and thus allow students methodologies that can increase their interest and stimulate their skills and competences, even outside the classroom.

And given the current situation we are in, point out Santos and Schntzler (2010) with frequent environmental problems and consequent health problems in the population, it is extremely important that the teacher is willing to know the historical and cultural context of the students, as only thus, it will be able to propose significant methodological strategies, considering the local and cultural reality of these students. According to Ribeiro *et al.* (2020) that the education of the student must be critical and participatory, thus breaking with traditional education, thus making it possible to improve their coexistence in the place and around where they live. Thus, Science, Technology, Society and Environment (CTSA)

becomes a strong tool.

Science, for Hodson (2018), is intrinsic and is defined as a distinct social practice and is widespread in the political, economic and social environment, generating, therefore, a great impact on its priorities and decisions.

Notwithstanding Sousa and Simões (2016) affirm that the teacher must be prepared for the reality of the Brazilian educational environment and the constant changes that the environment is subject to, on the premise of forming more and more conscious individuals to live in society. In this perspective, the school must encourage the teacher and contribute so that environmental education is inserted in the teaching-learning process. It should also be noted that it must be part of the student curriculum. That is, inserted in all disciplines, as the theme can be worked with different contents and in different ways in the classroom (Leite, 2015).

For Santos and Schntzler (2010) the teacher needs to plan his classes with a language that can facilitate for the student to understand the contents explained, in the intention, that people learn in different ways, and in different contexts. According to Chassot (2000) education must be engaged in the reality of the student, so that they realize that it is present in the simplest situations of life, thus abandoning dogmatism and abstractionism, in the bias that Chemistry must have a universal language.

According to Moreira and Masini (1982), there are two types of learning: mechanical and significant, in the significant the previous knowledge of the student is valued and contributes to his learning process, making it possible to make the student more interested, responsible and confident. The broader concepts are superimposed on concepts with less power of extension. On the other hand, mechanical learning and information is related in an arbitrary and impartial way in which the student behaves as a passive and non-participant in the process.

One of the ways of working with chemistry could be by providing environmental awareness in a dialogical way, where the student can actively participate in the process. Agrochemicals are feasible topics to be mediated in this way, not to mention that they can potentially increase students' interest in the discipline, and at the same time, improve their relationship with the

environment (Sousa and Simões, 2016).

OBJECTIVE

Identify the strategies for teaching chemistry at the medium professional and technological level present in scientific articles with the theme “pesticides”.

METHOD

The methodology chosen for this study was a qualitative approach centered on being concerned with reality, although the research that comprises the locus is linked to the quantitative, its nature is based on interpretation. For Moreira and Schittler (2016), this approach focuses on being concerned with the explanatory medium of social relations, from the students’ perspective.

In this way, the research is based on an exploratory bibliographic review, looking for data in works already carried out that are printed in digital media and, thus, selecting relevant studies for further discussion of the topic.

The data were collected on the Capes Periodicals platform and on the QNESC magazine website, using the descriptors “Chemistry”, “Pesticides and Learning” “Pesticides and Education”, and “Pesticides and Environment, covering the period from 2010 to 2020.

RESULTS

Ten (10) articles were identified (Table 1) and five (05) were selected that met the research scope (Cavalcanti *et al.*, 2010; Braibante and Zappe, 2012; Sá-Oliveira *et al.*, 2015; Souza *et al.*, 2015; Mello *et al.*, 2018; Pozzebon *et al.*, 2018; Salgado *et al.*, 2018; Silva e Leão, 2018; Ribeiro *et al.*, 2020; Vargas *et al.*, 2020).

Table 1 Shows the title of the identified articles, their authors, and the journals and years in which they were published.

	TÍTULO	(AUTOR(ES) / ANO)	PLATAFORMA OU REVISTA
1	Contradições Presentes na Percepção de Estudantes Secundaristas de uma Escola Estadual do Município de Campo Verde-MT sobre o Tema Agrotóxicos	(Ribeiro et al., 2020).	Revista Prática Docente
2	Método de Resolução de Problemas no Ensino Médio: uma proposta interdisciplinar abordando o Tema agrotóxico.	(Salgado et al., 2018)	Revista Prática Docente
3	Agrotóxicos no Ensino de Química: proposta contextualizada através de um jogo didático	(Mello et al., 2018)	Revista Eletrônica Ludus Scientiae.
4	Em Julgamento, o Uso de Agrotóxicos: estratégia utilizada para ensinar química a estudantes do 3º ano do ensino médio de uma escola do campo	(Silva e Leão, 2018)	Revista Prática Docente
5	A Utilização de Tics no Desenvolvimento da Temática “agrotóxico”: um quiz como ferramenta de apoio pedagógico	(Vargas et al., 2020)	ENCITEC - Ensino de Ciências e Tecnologia em Revista
6	Educação Ambiental no Ensino Médio: preservação, conscientização e busca pelo conhecimento	(Pozzebon et al., 2018)	Extensio: R. Eletr. de Extensão
7	Agrotóxicos: Uma Temática para o Ensino de Química	(Cavalcante et al., 2010)	Qnesc
8	Proposta Educativa Utilizando o Jogo RPG Maker: Estratégia de Conscientização e de Aprendizagem da Química Ambiental	(Souza et al., 2015).	Revista Química Holos
9	A Agroecologia na Percepção de Alunos de Ensino Médio de Quatro Escolas Públicas na Cidade de Macapá-Amapá	(Sá-Oliveira et al., 2015)	Biota Amazônia
10	A Química dos Agrotóxicos	(Braibante e Zappe, 2012)	Qnesc

The first article entitled: Contradictions Present in the Perception of Secondary Students of a State School in the Municipality of Campo Verde-MT on the topic of Pesticides, with a qualitative methodology, had as main objective the elaboration of a paradigmatic book on concepts of Chemistry and Biology. Articulates scientific knowledge with phenomena present in the students' daily lives. The research was carried out with forty-six high school students at the Escola Estadual Ulisses Guimarães. The work presented satisfactory results on the subject under study, the authors say, but it was observed that the students had contradictions in their perceptions about the theme.

The study entitled: Method of Problem Solving in High School: an interdisciplinary proposal addressing the pesticide theme and aimed to investigate the forms of didactic sequence carried out to learn conceptual and attitudinal contents related to environmental issues and with qualitative methodology. It was developed with thirty-five students from the 3rd year of high school. The results showed that there was an increase in students' awareness of the topic addressed and the consequences that these agrochemicals can cause to human and environmental health.

The research on the theme of Pesticides in Chemistry Teaching: a contextualized proposal through a didactic game aimed to investigate the potential and advantages of applying a didactic game for teaching Chemistry with the pesticide theme, as a strategy for teaching students from a public high school, with a quantitative approach. The results of the studies proved to be satisfactory, and the researchers also ratify that the application of a didactic game with this theme contributes to a more significant learning and helps in the theoretical-practical articulation.

The work entitled In Judgment, the Use of Pesticides: strategy used to teach chemistry to students in the 3rd year of high school in a rural school aimed to describe the simulation of a jury on the use of pesticides as a teaching method in chemistry. It used a qualitative approach and reports of experiences. With the development and execution of the research, the studies showed positive results, on the premise that the involvement of students and the search for information were extremely valuable for the construction and understanding of the subject in question, based on the reality of the citizen who lives in the countryside.

The research with theme: The Use of Tics in the Development of the "pesticide" Theme: a quiz as a pedagogical support tool consisted of reporting an activity developed and applied by scholarship holders of the Institutional Program for Teaching Initiation Scholarships (PIBID), with emphasis on the importance and effectiveness in using technology as a pedagogical resource through the Quiz Agrotóxico game. The methodology used was through games using technologies made in PowerPoint software. With the conclusion of the activities, the results were satisfactory, as the studies found the importance of technologies as a means of access and reinforcement in the content explained.

The research entitled Environmental Education in High School: preservation, awareness and

search for knowledge had the purpose of addressing environmental education for high school in a school in Itaquí- Rio Grande do Sul. Its goal was to stimulate awareness, preservation and search for knowledge with a qualitative methodology with the organization of technical and educational lectures for students. The results showed that 34% to 56% did not know the topics and 95% to 100% demonstrated that the community had no knowledge on the subject “environmental problems that affected the region”.

The study whose theme is Pesticides: a Thematic for the Teaching of Chemistry aimed to describe an intervention that was developed with students of the 1st, 2nd and 3rd year of high school. With a qualitative approach, the work involved students in the construction of concepts of Chemistry with the pesticide theme. The strategies were divided into different moments, namely: visualization of images, survey of students' previous conceptions, study of the environment, seminars, readings, interpretation and discussion of texts, integrated panels, group work and experiments. The results of the investigation showed successful results because, with the more active participation of the students, it was more beneficial to the evaluation, promoting, in this way, a greater participation and socialization of the ideas, thus allowing the student to act significantly in the construction of learning.

The investigation with the theme: Educational Proposal Using the RPG Maker Game: Environmental Chemistry Awareness and Learning Strategy aimed to propose a learning object based on the RPG Maker, which is an educational software, as a way of raising awareness and improving the teaching of Chemistry for high school students. The authors chose to do a case study on the subject, applied in two third year classes of high school. The results showed that the software made the work of the teacher more interesting and, with regard to the students, it was observed that the tool became a great strategy for the teaching-learning process, as the class became more dynamic, interactive and interesting, noting signs of a more reflective posture on the part of the students.

The article on the theme: Agroecology in the Perception of High School Students from Four Public Schools in the City of Macapá-Amapá aimed to verify the environmental perception of students in the 3rd year of high school in four state public schools and a qualitative approach and quantitative. With the execution of the research, the results showed that most students did not even know the topic of agroecology, but that somehow they performed such practices, even without knowing it. It was found that a portion of the interviewees had no

interest in the subject in question, as well as its consequences for the environment and people's health. A greater concern with soy planting in the region, deforestation and the use of pesticides in plantations was also identified in a greater part. They concluded, therefore, that most of these schools do not work agroecology and do not spread agroecological philosophy.

The study with the theme: Chemistry of Pesticides aimed to describe the history of pesticides, relationship with the discipline of Chemistry, as well as its consequences for the environment and for the worker using a qualitative methodology. Based on its results, it guides the teacher to use the theme in his classes, thus using different strategies that can contextualize the teaching of Chemistry to Pesticides that can be worked on in all grades of high school.

DISCUSSION

The education and training of teachers is intrinsically related to the current educational scenario. In the bias, that the use of themes that are related to everyday life can be a significant foundation in the learning of students. It is also emphasized that educators help to write the country's history and that in a way they are decisive in building future scientists. Thus, we must make teaching a language that can favor students' understanding of the world (Chassot, 2000).

It was observed that five of the ten researches (articles 3, 4, 5, 7 and 10) (Table 1) selected correlated the theme studied in their methodological practices, and with regard to unselected works it was noted that even citing the teaching of Chemistry in some points of their research, what was observed was that during the execution of their studies they did not relate in their methods.

In study 03, which involved concepts of chemistry and the environment, through the theme of pesticides, contents were introduced that are worked on in chemistry classes, for example, nomenclatures of the molecules present in pesticides (Mello *et al.*, 2018). This correlation is important because there seems to be few studies correlating chemistry with the resolution and prevention of environmental problems (Leal and Marques, 2008).

Regarding research 04, the simulation of a jury on the use of pesticides in the perspective of teaching chemistry to third year students at a rural school was a strategy that made it possible to discuss concepts such as the structure of the substances present in pesticides (Silva and Leão , 2018). Teaching using the correlation of everyday life seems to have a greater effect on the acquisition of knowledge in the area of natural sciences (Carmo *et al.*, 2021).

Study 05 reports a learning method that was the use of TICS through a game called QUIZ through the power point software, addressing discursive chemistry issues present in the National High School Exam (ENEM) (Vargas *et al.*, 2020). Students who intend to enter Brazilian higher education use this exam. Therefore, teaching that uses questions like this can increase the allowances for the student to succeed in entering the third grade (Gortz *et al.*, 2021).

Work 07 addresses a didactic intervention involving the theme pesticides and the content of teaching chemistry as acids, bases, and organic functions. This seemed to involve students in building their own knowledge (Cavalcanti *et al.*, 2010). Didactic interventions are instruments that increase the contextualization of subjects and, consequently, the apprehension of knowledge, being used in several components of teaching. (Bedin, 2019).

Article 10 describes the history of pesticides, correlating the theme with the teaching of chemistry in the first, second and third years. A table of contents was organized that the teacher can use to teach, associating the theme addressed to chemistry (Braibante and Zappe, 2012). Studying this history helps to deepen the interconnection of pesticides, a chemical product, and considerations about its influence on the environment. Scientific appropriation gives the student the structure to understand the consequences of its use and the possible ways of sustainable use, even in small environments such as home (Moraes *et al.*, 2011).

CONCLUSIONS

The observation of this brief survey allows us to conclude that:

- The teaching of chemistry in high school groups can and must be related to the area of

research and scientific dissemination;

- There are several didactic tools that enable more assertive ways related to teaching chemistry;
- Relating the content of chemistry to interdisciplinary and specific subjects, such as pesticides, can help a better understanding of the content of chemistry in high school students.

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