Some propositions about including students with disabilities in chemistry teaching

Algumas proposições sobre a inclusão no ensino de química

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ABSTRACT
In this article, we present the results of a Scientific Initiation research with high school students (this is called Pibic-Jr, in Brazil) that shows and discusses the panorama of scientific productions about the use of educational software in chemistry teaching, focused on inclusion of students with disabilities. The bibliographical research was conducted between 2007 and 2017 in the Química Nova na Escola Journal, a free Brazilian magazine [for readers], with reports and research from the area of Chemistry Teaching and, generally, present in undergraduate courses in Chemistry and Natural Sciences. The obtained results were organized in tables for our discussion. Many of the materials produced have been effective in the educational process, especially in chemistry teaching. However, we also realize that, even after the intensification of the study on the development of educational technologies, it is important to expand the investigations, but in the bias of the use of these technological resources to enable the inclusion of students with disabilities in the chemistry teaching.

Keywords: Inclusion of students with disabilities, software, Chemistry Teaching.

RESUMO
Apresentamos, neste artigo, os resultados de uma pesquisa de Iniciação Científica Júnior (Pibic-Jr) que mostra o panorama das produções científicas que discutem a utilização de Softwares educacionais no ensino de Química, voltados para a Inclusão de estudantes com deficiência. O levantamento foi realizado no período entre 2007 e 2017 na Revista Química Nova na Escola, um periódico brasileiro, gratuito, com relatos e pesquisas da área de Ensino de Química e, geralmente, presente nos cursos de formação de professores de Química/Ciências. Os resultados obtidos foram organizados em tabelas.
para triangulação dos dados. Muito dos materiais produzidos tem sido eficaz no que tange as ações que enfatizam a participação dos estudantes no processo de ensino e aprendizagem. No entanto, percebemos também que, mesmo após a intensificação dos estudos sobre o desenvolvimento de softwares tecnológicos, é importante ampliar as investigações, mas no viés do uso desses recursos para favorecer a real inclusão no Ensino de Química.

Palavras-chave: Inclusão, softwares, Ensino de Química.

1 INTRODUCTION

Schools often have difficulties in developing learning actions with students with Special Educational Needs (Necessidades Especiais Educacionais - NEE, in Portuguese). These difficulties generally pass through the limitations of physical infrastructure, working conditions for teachers, continuing education for education professionals, teaching methodologies, among other aspects (SOUZA, 2014). In addition, it is also important to point out that students do not develop cognitively in the same way. Therefore, research in the area of Science Teaching, focused on Inclusive Education, which seeks teaching strategies and also has the support, when possible, of technological tools is essential (SOUSA and SILVEIRA, 2011; SANTOS; MEDEIROS; RIBEIRO, p. 83, 2017).

According to Megid Neto et al. (2005) - in his study of the state of the art between 1972 and 2004 on trends in science teaching research in Brazil - there was no record, for example, of studies with deaf students, for example, until 2004 in the area of Sciences. One of the many difficulties in the Brazilian educational system is based on classes that often do not allow students with special needs to be included as active participants in the learning process (REIS and SILVA, 2012).

We still have difficulties to achieve a teaching that is, in fact, inclusive, as Santana (2005) points out: "what is being done is not enough to meet the demands that arose during the inclusive process" (SANTANA, p. 231, 2005). However, with technological advancement changes in didactic strategies are getting closer and closer to being made. Technology coupled with contextualized and interdisciplinary teaching can bring several benefits, as pointed out by Santos, Medeiros and Ribeiro (2017) "once the school and teachers are inserted and interacting with the digital world [...], the bigger will be the possibilities of ensuring a quality education in leading students in search of new knowledge "(p. 95).

Thus, this paper aims to present a bibliographic survey of works published in the journal Química Nova na Escola (QNEsc) between 2007 and 2017 that relate the use of educational software for inclusion in chemistry teaching, as well as tabulate the information acquired to present the current situation of this theme in the context of the publications in that journal.
2 METHODOLOGY

To date, the literature review was conducted at the Química Nova na Escola Journal (QNEsc) between 2007 and 2017. The results were obtained through the following descriptors in the abstracts, titles and/or keywords: educational software; software; inclusion; chemistry teaching; science teaching; special education; special needs at school. After finding the texts, we read the abstracts and selected those who had discussions about inclusion or teaching chemistry.

Later, tables were constructed with the following categories: title of the paper; profile of the author(s); Brazilian state and region; volume, issue number and year the work was published; job category. Such organization of the collected data provided a better interpretation of the information.

Thus, two tables were made: the first on the scientific productions aimed at inclusion; and the second, focused on educational software for chemistry teaching. It is necessary to point out that in future works will also be presented a third table that explains the intersection and discussion between inclusion works and software for Chemistry Teaching, as well as graphs that identify important aspects of this research, such as: examples from inclusive experiments conducted through educational software that had an impact on basic education, especially chemistry teaching (we will elaborate categories for this item); locations / regions of Brazil where these surveys are concentrated; profile of researchers conducting investigations of this nature.

3 RESULTS AND DISCUSSION

Four hundred and forty eight (448) articles and twenty four (24) reviews were found. Of this total, there are 22 articles and one review selected for the analysis, 9 articles discussing the inclusion in chemistry teaching (Table 1), which represents 1.90% of the texts published in QNEsc; and 13 articles and 1 review (Table 2), referring to 2.96% of the articles in the journal that indicate reflections on educational software for chemistry teaching. Research shows that Technologies have entered school spaces in all Brazilian regions (GUMARÃES, SOUZA, NUNES, 2018) and consolidating themselves as tools that lead students to learn.

The productions published in QNEsc tend to contribute to actions in Basic Education, favoring, in fact, including teaching. For this, the appropriation of the various methodological resources, such as educational technologies, is fundamental. Among the technologies used are software that can provide more contextualized and interdisciplinary education, as highlighted by Santos, Medeiros and Ribeiro (2017). The intersection of the date (expected in future works) has not yet been done and therefore the results were not triangulated allowing a reasoned discussion and notes that delineate research on these topics in Brazil. However, from the preliminary date obtained it is
possible to notice the low amount of research related to the inclusion or educational software in chemistry teaching, presented separately.

**Table 1:** Papers published, about inclusion, between 2007 and 2017.

| Paper                                                                 | Profile of the authors | State | Region    | Vol. | N. | Year | Category |
|----------------------------------------------------------------------|------------------------|-------|-----------|------|----|------|----------|
| Periodic Table: a Super Trinket Game for elementary and high school students. | IC (one author); PQ (two authors) | SP    | Southeast | 32   | 1  | 2010 | Teaching material |
| Chemical terminology in Libras: the use of signs in the learning of deaf students. | PQ (one author); PG (one author) | MG    | Southeast | 33   | 1  | 2011 | Sign elaboration |
| Chemical class and deafness: about teaching interactions mediated by vision. | FM (one author); PG (one author); PQ (one author) | GO    | Midwest   | 33   | 1  | 2011 | Teaching methodology |
| Using the board ludo, in the evaluation process of learning of deaf students. | PQ (two authors) | BA    | Northeast | 36   | 1  | 2014 | Teaching material |
| Ten years of Libras' law: a compendium of the studies published over the last 10 years in the annals of the meetings of the Brazilian Chemical Society. | PQ (two authors); PG (one author) | Not identified | Not identified | 36 | 3 | 2014 | Literature review |
| Experimental kit for the analysis of CO₂, for use by visually students. | PQ (four authors); IC (one author) | MG    | Southeast | 37   | 1  | 2015 | Teaching material |
| Reflections on the formation and pedagogical practice of a blind chemistry teacher. | PQ (two authors); PG (one author) | AC    | North     | 37   | Special | 2015 | Formation and pedagogical practice |
| Inclusive Teaching Strategy to Deaf Students for Teaching the Concepts of Balancing Chemical Equations and Stoichiometry in High School. | PQ (one author); PG (one author) | MG    | Southeast | 39   | 2  | 2017 | Teaching material |
| Teaching chemistry for deaf students: the concept of mixtures in science classes. | PG (one author); PQ (two authors) | GO    | Midwest   | 39   | 4  | 2017 | Teaching methodology |

*Source: os authors (2017).*

**Table 2:** Works published, about Software, between 2007 and 2017.

| Paper                                    | Profile of the authors | State | Region    | Vol. | N. | Year | Category               |
|------------------------------------------|------------------------|-------|-----------|------|----|------|-------------------------|
| Teaching chemistry in virtual environments | PQ (one author)     | SP    | Southeast | 32   | 2  | 2010 | Virtual environment     |
| Cyberculture in chemistry teaching: developing a   | PQ (two authors); GO | GO    | Midwest   | 33   | 2  | 2011 | Teaching               |
### Virtual Learning Objects for Teaching of Atomic Models

| Title                                                                 | Authors       | Location | Year | Number | Type       |
|----------------------------------------------------------------------|---------------|----------|------|--------|------------|
| Combined Use of Conceptual Maps and Diversified Strategies of Teaching: An Early Analysis of Chemical Bonds | FM (one author); PQ (one author) | MG Southeast | 34   | 2      | 2012 Teaching material |
| Chemistry Teaching Games: Theoretical Considerations for Classroom Use. | PQ (one author) | Not identified | Not identified | 34 | 2 | 2012 Teaching material |
| Simulation Software in the Teaching of Atomistic: Computational Experiments to Show Micro worlds. | IC (Three authors); PQ (one author) | PE Northeast | 35   | 3      | 2013 Simulation |
| The Nobel Prize in Chemistry 2013. | PQ (one author) | SP Southeast | 35 | 4 | 2013 Modeling |
| Audiovideo Production as a Pedagogical Practices for Teaching Legislation in Chemistry Course. | PG (one author), PQ (two authors) | RJ Southeast | 36 | 3 | 2014 Teaching material |
| Interactive Periodic Table. | PQ (one author), PG (two authors) | MG Southeast | 37 | 3 | 2015 Teaching material |
| Analysis and reflections on the articles of the section Chemical Education and Multimedia published between 2005 and 2014. | PQ (one author) | Not identified | Not identified | 37 | Special | 2015 Literature review |
| Isomers, Functions Organic and Free Radicals: Analysis of Learning Students of Secondary Education | PG (two authors) | PE Northeast | 38 | 1 | 2016 STS Education |

#### According to Approach STS.

| Title                                                                 | Authors       | Location | Year | Number | Type       |
|----------------------------------------------------------------------|---------------|----------|------|--------|------------|
| Use of software education (SE), learning objects (OA) and simulation in chemistry teaching. | PG (one author) | Not identified | Not identified | 38 | 2 | 2016 Teaching material |
| Innovative instructional resources for teaching chemistry. | PG (one author), PQ (one author) | RJ Southeast | 39 | 1 | 2017 Teaching material |
| A Walk in the Dairy Industry Game for Environmental Education in the Food Technology Course | PQ (four authors) | RN Northeast | 39 | 2 | 2017 Teaching material |
| The Common Sense of Chemical Knowledge Development: Use of Didactic devices Pedagogical Mediation in Educational Practice. | PQ (four authors) | SP Southeast | 39 | 4 | 2017 Teaching material |

### 4 CONCLUSIONS

The present paper refers to part of a research of Scientific Initiation of High School of the Federal Institute Goiano – Campus Catalão. The number of bibliographic references, as well as didactic materials that point to pedagogical strategies aimed at inclusion, in Brazil, are, until the present moment, little representative (SOUZA; SALLES, GAUCHE, 2016), but the search and survey of studies on Inclusion continues and, albeit slowly, we believe in teaching that is, in fact,
inclusive in Primary/Elementary/High Schools (These are Basic Education – ‘Educação Básica’, in Brazil).

The results shown in this paper make us reflect on the inclusive Science Education in the country. The fact is that finding classrooms without students with special needs is no longer uncommon. So if we have the technologies to help us in a more than urgent education for all, we need to mobilize academics for this kind of research. If we think about the initial discussions about inclusive education in the country and compare with what we have today, we realize that there was an advance, but still small given the complexities we have in schools.

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