

CONCEPTIONS OF INDIGENOUS STUDENTS IN EARLY TRAINING ABOUT CHEMISTRY AND ITS EDUCATION

CONCEPÇÕES DE ESTUDANTES INDÍGENAS EM FORMAÇÃO INICIAL SOBRE A QUÍMICA E O ENSINO DESSA DISCIPLINA

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Abstract

This text describes the conceptions that some indigenous students in early training from Mato Grosso hold about chemistry and chemistry education. The research investigated eleven students from ten different ethnicities from a specific course for indigenous people, named Graduation in Mathematical and Natural Sciences at UNEMAT, Barra do Bugre-MT campus. This survey, descriptive and exploratory, is of a qualitative approach and took place in the first semester of 2014 during the Chemistry Education course. The choice of images to illustrate the chemistry before the training activities and a questionnaire consisting of three open questions and completed at the end of the course were the instruments used to collect data. The interpretation of these reports occurred through the technique titled Content Analysis. The images chosen and their justifications revealed the limited conception that the students held before the subject. From the data gathered four categories emerged: previous conceptions about chemistry and its performance; aspects of the student's trajectory; definition of ideal classes and contributions of chemistry to life. The study revealed the conceptions these indigenous students and future teachers hold about chemistry and teaching this discipline.

Keywords: Chemistry education. Teacher training. Indigenous.

Resumo

Este texto descreve as concepções que alguns estudantes indígenas mato-grossenses em formação inicial possuem sobre a química e o ensino desta disciplina. A investigação envolveu onze estudantes, de dez diferentes etnias, do curso específico para indígenas de Licenciatura em Ciências Matemática e da Natureza da UNEMAT, Campus de Barra

do Bugres-MT. Esse levantamento, descritivo e exploratório, possui abordagem qualitativa e ocorreu no primeiro semestre de 2014, no decorrer da disciplina de Química para o Ensino. A escolha de gravuras para ilustrar a química antes das atividades formativas e um questionário constituído por três questões abertas, preenchido ao término da disciplina, foram os instrumentos utilizados para coletar dados. A interpretação destes relatos ocorreu por meio da técnica intitulada Análise de Conteúdo. As gravuras escolhidas e suas justificativas revelaram a concepção limitada que os estudantes possuíam antes da disciplina. Dos dados coletados emergiram quatro categorias: concepções prévias sobre a química e sua atuação; aspectos marcantes na trajetória estudantil; definição de aulas ideais e contribuições da química para a vida. Com o estudo foi possível verificar a concepção que esses estudantes indígenas e futuros professores possui sobre a química e o ensino desta disciplina.

Palavras-chave: Ensino de química. Formação de professores. Indígenas.

Introduction

The early training trajectory provided by the licentiate degree courses may be considered as a precious moment when understanding the scientific concepts that are to be taught, as well as the pedagogical aspects involved to teach such concepts occurs, which is a determining factor in the construction of the teacher identity. In this sense, it is the duty of the licentiate degree courses to provide instances to reflect upon what the science which they pore over represents, its contribution to humanity, as well as about the manners in which such knowledge may be taught in schools.

However, that is not the reality encountered in the chemistry licentiate degree courses. According to Predebon & Del Pino (2009), few are the moments provided by the licentiate degree courses in the area that allow to reflect upon the nature of the science for the available educational practices to teach such knowledge to occur. In the authors' view, the existence seems evident, during early chemistry teacher training, of conceptual, didactic and practical aspects being unlinked, which becomes a hurdle to be overcome in order that there be no losses for the future action of teaching by those who are undergoing training.

Furthermore, Afonso & Leite (2000) understand that students in the training process have little previous knowledge of chemistry and how to teach it, many of which were constructed during their own school background, and those conceptions about science and its teaching need to be taken into consideration. The same authors deem such conceptions future teachers carry about didactic aspects of teaching to have been constructed along the experiences had during Basic Education and also in early Higher Education.

Harres et al. (2005) present several national and international studies in which researchers, by poring over teacher training, revealed the trend and the necessity to develop investigations already along the path of early training. Thus, this study was carried out with the intent of investigating the early conceptions and those that were constructed

along the training trajectory of this licentiate degree course that includes the particularity of involving a different culture.

Studies by Leite & Rodrigues (2018) identified and discussed the conceptions of 51 scholars from a Chemistry Licentiate Degree course in Paraná about the social and scientific aspects developed during the training process. The authors highlight that the scientific studies are fundamental for early teacher training by leading students to pursue solutions for any problems.

Another aspect to be considered is that teacher training requires more than personal dedication, as claimed by Nóvoa (1997, p. 28):

[...] just as training may not be dissociated from the production of knowledge, we should not be estranged of an intervention in the professional terrain. Schools will not change without the effort of teachers; who in turn will not change without a transformation of the institutions where they work.

In other words, discussing early training does not exempt the training institutions from responsibility, or their trainer teachers, let alone the future chemistry teachers who are the actual agents of their training and who need to be in constant pursuit of perfecting their knowledge.

That assertion is corroborated by Libâneo (1998) who affirms that teachers need to rethink the didactic-pedagogic objectives in such a way as to link those with reality, with the concepts, with education and the technical-scientific-computational society beyond discourse. The reason for that is because contemporaneity requires skills and knowledge that constitute primordial factors for the insertion of man in society, mainly in the employment marketplace. Teachers are one of the components that contribute greatly towards that occurring satisfactorily.

According to Article 11 in the CNE/CP Resolution nr. 1 from 2015 that institutes the national curricular guidelines for indigenous teacher training, the indigenous teacher training curricular proposal should tend to the specificities of that teaching profile and should be constructed respecting and valuing “the theoretical and methodological teaching and learning conceptions of each indigenous people and community”. The single paragraph in Article 12 reports that the following is to be considered in the curricula: “II - indigenous knowledge and their ways of production and expression; IV - consonance of the indigenous school curriculum with that of the indigenous teacher training within a reflexive and transforming perspective”.

This way, the construction of a base during early training must include varied knowledge that should allow future teachers to understand and act within their school reality, in addition to solid training on the specific reference area concepts in order that, when associating didactic strategies more favorable to such concepts, effective actions occur towards their students learning.

One piece of research carried out in this sense of early training is that developed by Firme & Amaral (2008) that sought to investigate chemistry teacher conceptions on Science, Technology and Society (STS) and its interrelations, since the authors believe

that it is necessary to start from those conceptions for STS to be approached in the classroom.

The investigation by Harres et al. (2012) took place by means of reviewing 18 research pieces carried out between 1995 and 2005 that were published in international journals about teacher training. That revision showed, up to a point, “the evolution of the conceptions and practices of future teachers towards a greater consideration of students' ideas seems to be a more complex process than simply implementing an innovative training curriculum” (HARRES et al., 2012, p. 63).

In turn, the study developed by Afonso & Leite (2000) diagnosed the previous conceptions of future teachers on the use of laboratory activities. At the time it was proposed that students under early training elaborate an experimental activity to teach the concept of chemical reactions as if they were teachers for the 8th grade of the elementary stage, which reminded the future teachers of activities already experienced and choose the one they deemed most adequate.

The investigation carried out by Predebon & Del Pino (2009) also took on as its starting point the pedagogical and conceptual conceptions students under training and future teachers held about chemistry and how to teach it by means of analyzing didactic models aimed at teaching chemical concepts. On that occasion, it was possible to identify previous knowledge and the evolution that was had about the didactic models by means of didactic units elaborated during the proposed didactic activity that prioritized the investigative didactic model.

Other studies have certainly been developed in the sense of considering students' pedagogical conceptions in early chemistry teacher training, however, there are but a few studies involving indigenous teacher training. As Crepaldi (2012) points out, the indigenous culture is rich and dynamic, containing a wealth of singularities and specificities, which makes studying this area interesting.

From the above exposed, the objective of this study was to identify the conceptions of some indigenous students from the Mathematical and Natural Sciences Licentiate Degree Course at the Indigenous College in the Mato Grosso State University (UNEMAT) about chemistry and the didactic-pedagogic aspects involved in teaching this subject. This study relied on financial subsidy of Call Notice 069/2018 from PROPES/IFMT and on support from the IFMT concerning the scholarship for the first author's doctoring (Call Notice 079/2016).

Methodological Procedures

This study is configured as a survey of the conceptions on chemistry teaching indigenous students received and deem necessary to be able to perform as teachers. It is a descriptive, exploratory study from a qualitative approach. According to Gil (2007), this type of study is indicated for those investigations that involve social behavior and allows to disclose its assumed conceptions or postures, in addition to involving existing theories on the subject and the data gathered from the context of the descriptive action, or even from the description of situations of a subjective character.

The investigation with the indigenous students under training took place during stage IV of the Mathematical and Natural Sciences Licenciature Degree Course attendance studies offered by the Intercultural Indigenous College at the UNEMAT Barra do Bugres-MT Campus in Midwestern Brazil. It was developed throughout the first semester of 2014 as the subject Chemistry for Teaching was taught. It is worth registering that this is a specific training course for indigenous teachers, being one of the pioneering courses on this specificity in Brazil.

This Specific Licenciature Degree Course for Indigenous Teacher Training comprises three basic years followed by two specific years during which teachers choose among three qualifications: Languages; Arts and Literatures; Mathematical and Natural Sciences and Social Sciences. So, the fourth year stage corresponds to the first contact students have with the specific knowledge subjects, that is, it is the first time the subject chemistry has been offered to the class.

These indigenous-specific licenciature courses offered by the UNEMAT Intercultural Indigenous College are aimed at reaffirming the ethnic identities and ensuring access to technical and scientific knowledge in such a way as to qualify for teaching, tend to its specificities and, this way, contribute towards the traditional communities by means of qualified professionals to work in the schools installed in the villages.

The investigated public comprises eleven indigenous trainee students belonging to 10 different ethnicities, namely: Bakairi, Bororo, Irantxe, Nambikwara, Rikbaktsa, Terêna, Xavante, Myky, Ikpeng, and Suruí. Their traditional communities are located in the following towns in Mato Grosso: Paranatinga, Rondonópolis, Brasnorte, Sapezal, Juara, Guarantã do Norte, Canarana, Barra do Garças, Brasnorte, Feliz Natal, and Rondolândia. They all volunteered to take part in the study by signing the Term of Consent (ToC)

For gathering data and previous conceptions about the topic, the first activity that was developed in this subject was to have students select two images that illustrate their conceptions of chemistry and its outreach. The activity was requested through the following announcement: Choose one image that illustrates a situation in which you perceive the presence of chemistry and another in which you do not perceive chemistry acting. Justify your choices.

Maciel, Curi & Pereira (2013) consider the indigenous students as being extreme observers regarding everything that takes place around them, being able to describe in detail the natural aspects of their environment such as the behavior of animals, the beauty and diversity of existing plants, climate shifts and the relations among the elements that constitute nature. That is, the proposed activity will serve to ascertain the concept of chemistry they hold and its perceptions in the environment.

For selecting the images, several magazines containing the most varied images were made available. They were also offered scissors to cut out their chosen images. It was requested that the justification for their choices be in writing, which facilitated the socialization of their early conceptions at the end of the activity.

One other instrument used to gather data, albeit applied at the end of the subject, was a questionnaire comprising three open questions. The printed questionnaire served to ascertain important information about the conceptions indigenous students hold about the

act of teaching chemistry. To ensure participant anonymity, their names were replaced by alphanumeric figures as follows: indigenous student 1 (IS 1); indigenous student 2 (IS 2), and so forth.

The analysis methodology utilized to interpret the results was content analysis. According to Bardin (2012), this manner of analyzing data allows to extract from the answers provided by the investigated participants messages and meanings they hold about the topic being analyzed. The categorization employed was emerging and involved the rating of the constituent elements in the answers through differentiation and then regrouping according to similarity and frequency.

Results and Discussion

Four categories emerged from the data gathered, according to Chart 1. The categories created for the analysis are not exclusive, another researcher could suggest others that differ from these.

Chart 1: Schematics of the results categorization

Categories	Sub-categories	Sources/Questions
1. Previous conceptions about chemistry and its action	a) Presence of chemistry	Choice of and justification for the images
	b) Absence of chemistry	
2. Impacting aspects from your student trajectory	a) Difficulties faced	1) How were your sciences and chemistry classes during your schooling?
	b) Positive trajectory	
	c) Learnings constructed	
3. Definition of ideal classes	a) Concept comprehension	2) What is a good chemistry class?
	b) Experimentation	
	c) Strategy planning/utilization	
4. Contributions of chemistry to life	a) Understanding nature	3) How can chemistry contribute to people's lives?
	b) Quality of life	
	c) Presence in daily life	

Source: Elaborated by the authors (2018).

The first category relates to the previous concepts the investigated participants held about chemistry and its presence in daily processes. This category emerged from the data gathered from the initial activity of selecting images and justifying that choice.

For this text, 6 images were selected out of 11 for the situations associated with chemistry (Figure 1) and another 6 out of 11 images in which the presence of chemistry is not perceived (Figure 2).

Figure 1: Selection of images associated with the presence of chemistry.



Source: Data collected from the research (2014).

The first image chosen (Figure 1A) was justified as follows: “The processed juices and soda are blended with many chemicals such as colorings, sugar, preservatives and many others. In general, processed foods are bad for man's health” (IS 1). The image of a soda can (Figure 1B) was chosen for the following reason: “I chose the guaraná because it contains a chemical composition with several products in addition to the fruit flavor that are used for it to last longer after undergoing various processes. The can is also a good example of a chemical representation” (IS 3).

The justification for Figure 1C was the following: “Deodorants are products that contain many chemical substances that together present a specific formula and a pleasant smell for people to be able to wear” (IS 5). The investigated participant who selected a mobile phone set (Figure 1D) justified it as follows: “The mobile phone set is constituted by many chemical elements that when combined correctly are of great use. However, the device battery cannot be discarded anywhere as it is highly toxic and hazardous” (IS 6).

The choice of Figure 1E was motivated by the following understanding: “The industries produce a lot of smoke and pollute our air. I believe the chemical components in that smoke are toxic and harmful for people and nature” (IS 8). The justification by the investigated participant for Figure 1F was the following: “From my point of view, medication is a good representation of chemistry, not only due to the composition by various substance and elements, but also the resulting effects on the human body” (IS 9).

In general, the images selected to illustrate the presence of chemistry remit to industrialization processes and the environmental issues it causes when not well utilized. One aspect of concern that is present in the above choices and justifications is the fact that some investigated participants associate chemistry as something bad and hazardous.

It is worth remembering that the investigated participants are indigenous trainee teachers in their fourth year of studies, that is, this has been their first contact with

chemistry-specific subjects. However, even with this ascertainment being about their early conceptions, from the justifications and images chosen it is considered that the chemistry language adopted to justify such choice was a simplistic one, with technical characteristics. This finding points out indications that need to be worked on throughout this training process so that no failures occur regarding the aspects that would allow for correlating scientific, technological knowledge and the social and natural environment.

One other aspect that comes to attention regarding the image justifications is that they could have received a bias that would direct towards the indigenous experiences, for example, in images 1A, 1B and 1C, there could have been a correlation between products/substance/formula/elements that were manufactured industrially to imitate the flavors, odors and colors found in nature. Image 1D could have been related with metals found in nature. Further still, the toxicity (1F) and medication from naturally obtained products that are used by whites and indigenous peoples and that also serve to cure or kill, depending on the chemical composition or concentration. As to pollution, there could have been criticism made regarding the non-indigenous exploration process and destruction of natural assets.

It is also highlighted that the magazines provided contained images of both anthropized and natural situations, and none of the investigated individuals related a single example of the presence of chemistry in a natural situation, revealing a lack of or difficulty in correlating situations deemed as having chemistry present with aspects of their culture or experiences.

The mistaken conception of chemistry, widely recurrent in the social mindset according to studies by Leão et al. (2017) must be overcome for chemical science to be properly comprehended and may thus meet its objective that is to serve humanity. Towards that sense, Firme & Amaral (2008) must be considered when they advocate that early training and the conception that the teachers of this science hold about STS interrelations are determining factors to develop adequate chemistry teaching in schools.

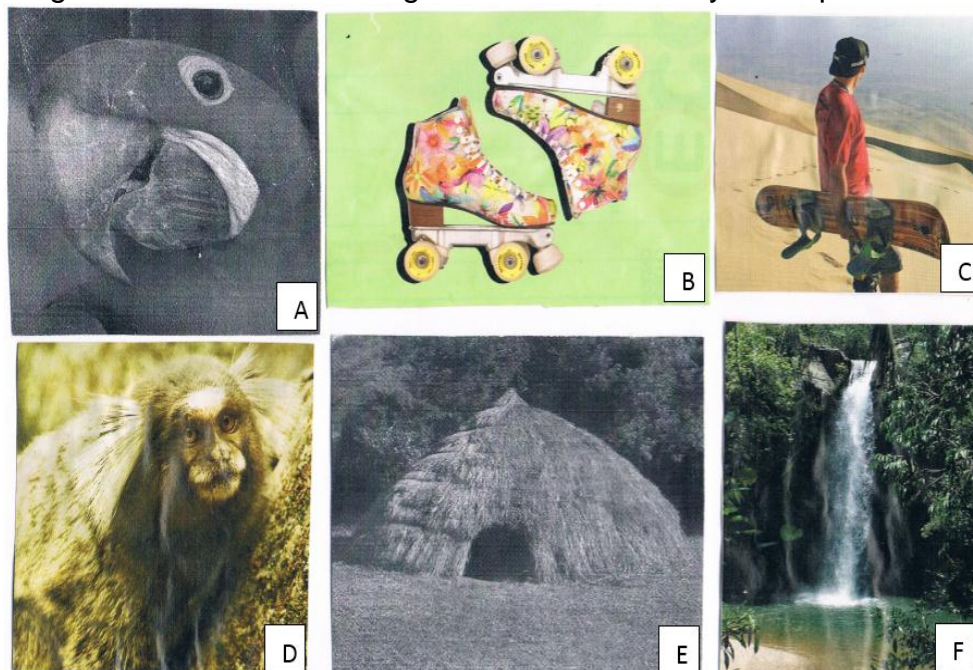
Towards this sense, early teacher training plays a decisive role for the education process in order that the necessary adaptations may occur. To quote Perrelli (2008, p. 381) “the school curriculum as a place of dispute for the legitimacy of expressing the knowledge of distinct cultures”. The author found that, among the indigenous peoples, the methodology employed when defining the curriculum is one of respecting and valuing their customs and way of life.

This link between cultural knowledge and science knowledge is corroborated by Santos & Lopes (2013, p. 149), who brought to evidence the need for a “curricular proposal that is specific for traditional communities, such as the indigenous peoples, but that is constantly assessed, taking into consideration the specificities of each ethnicity and the possible relations with non-indigenous peoples”.

For such, the curricular proposal for teacher training, as stated in CNE/CP Resolution nr. 1 from 2015, already discussed above, must meet the specificities of this culture in order to make it possible to establish relations between scientific concepts and daily life in such a way that such teaching gain sense and meaning, making it not only reflexive, but transforming.

Figure 2 shows the images selected to illustrate situations in which the investigated participants did not perceive chemical action. It can be perceived in their vision that the absence of any anthropic action reveals an environment with no presence of chemistry.

Figure 2 – Selection of images in which chemistry is not perceived.



Source: Data collected from the research (2014).

Figure 2A was chosen and justified as follows: “The macaw is a beautiful animal that does not have any relation with chemistry, for not having to undergo any man-caused transformation” (IS 2). The pair of roller skates (Figure 2B) was the image chosen followed by the justification: “I chose the roller skates to represent something that has no direct relation with chemistry because they do not require any preservatives or acids, nor fuels or batteries to be used” (IS 3).

The choice of Figure 2C was founded on the following justification: “I consider the landscape as not being very related to chemistry, since it represents nature itself: the sky, the waters, man, the sand. They are all products of nature itself” (IS 4). The investigated participant who selected Figure 2D justified it as follows: “The golden lion tamarin is an animal that is present in nature whose life is preserved from all those chemical products and processes” (IS 7).

The justification for Figure 2E was the following: “I consider the hut as something very natural, that is, there are no chemicals involved in its production, only raw materials that are found in nature itself” (IS 9). The choice of Figure 2F was justified in the following manner: “The water from the fall is an example of something contained in nature with no intervention from man. It serves to drink and to bathe in because it is not polluted with chemical products” (IS 11).

It can be perceived from these images that were judged as not representing chemistry action (except for Figure 2B) that they are those involving natural elements such as: forest animals, natural environments, persons, plants, among others. These data may also be deemed as being of concern, since the investigated participants do not associate

chemistry with natural processes such as human breathing, the composition of nature's materials, photosynthesis, among others.

What these justifications seem to express is that there are processes that occur spontaneously in nature and others that require anthropic action, and the latter are attributed with the action of chemistry. As in Figure 1, it is once more possible to perceive in Figure 2 that they associate chemistry with something bad, and something they consider to be good as if it did not contain chemistry, which is bad because the investigated participants do not notice the presence of chemistry in a natural environment.

For this reason, it becomes evident that there is a need for training institutions to offer situations for the production of well-founded, critical knowledge of science, even if such intervention occurs later in the professional terrain, as advocated by Nóvoa (1997), as is the case with this training course specific for indigenous teachers.

According to Santos & Lopes (2013), the official documents that guide the educational process in Indigenous Schools in Brazil advocate the possibility of a differentiated curriculum, that is, that it include the local reality as a starting point, involve elements of their culture, utilize new and varied teaching strategies and make possible the conveyance of the scientific concepts in a way that they gain meaning. However, "the curriculum, as a body of subjects developed in the school, is not substantially distinctive from any other curriculum developed in schools outside the village" (PAIXÃO, 2010, p. 161).

Considering the above discussions about the ideal curriculum and that which actually exists in the indigenous schools, it is expected that chemistry teaching be rethought within the purposes and cultural contexts of each indigenous community (GRUPIONI, 2008), which contrasts with the results presented in the choice of images and justifications in this research.

Regarding the impacting aspects in their student trajectory, that is, the second category, three sub-categories emerged. Some difficulties the students recalled were: "When studying that knowledge I had great difficulty with comprehension, so I did not like it" (IS 3). "I had teachers who were not trained in that knowledge, which was a bit of a hindrance" (IS 5). "The school where I studied did not have laboratories and I never got to do any experiments until now in the subject we are studying" (IS 6). "On top of the difficulties of those contents, my school did not have laboratories to do experiments" (IS 8). "I had never studied the chemistry subject, not during my basic education teacher training, nor in previous studies, only now in this subject" (IS 9). "I did not have classes with teachers who were trained in the topic, but always deemed the topic interesting, have always been curious to read more about the book contents" (IS 11).

As to the positive aspects that impacted that trajectory, below are some reports: "Chemistry classes were very relaxed. We improved our knowledge of materials and their uses" (IS 1). "The classes on this knowledge were interesting, which made me like sciences" (IS 7). "I had no specific chemistry lessons, but the sciences classes were very productive" (IS 9).

It can be perceived from the statements that some bad recollections prevailed regarding chemistry classes, mainly related to not comprehending or not learning this science. Such difficulty may be related to not interconnecting scientific knowledge with daily life, or according to Rocha & Vasconcelos (2016), there is still the persistence in chemistry teaching of 'traditional and decontextualized pedagogical practices', which contributes to student demotivation.

About learning constructed during their student trajectory came to mind: "I learned about nature, about materials and their transformations" (IS 1). "During intermediate

education, the themes studied were more directed towards technology and modernity, which led me to think about where our culture stands” (IS 2). “Chemistry helped me understand how nature is organized” (IS 7). “We studied a lot about taking care of natural resources” (IS 9). “I studied about the technologies, space, body movement, energy and many other important subjects involving chemistry” (IS 10).

By analyzing the statements, it can be perceived that the knowledge acquired during their student trajectory belonged to the field of modern, technical knowledge. Considering the statement by student (IS 2) and the need for contextualization that “especially in the field of chemistry, it can be perceived that indigenous contributions are evident, but recognition of those peoples does not occur and what is witnessed is that such diffusion does not happen not even in schools” (ROCHA; VASCONCELOS, 2016, p. 3).

It is highlighted that without the indigenous contributions and knowledge, pharmaceutical and chemical industries, as well as medical knowledge, would have a more modest growth. “Without their intervention, there would be no rubber industry, for example and, *a fortiori*, let alone an automobile industry” (SOENTGENA; HILBERT, 2016, p. 1148). Faced with such recognition, chemistry classes could contain a wealth of connections between scientific knowledge and the traditional knowledge of those peoples.

In the third category, the investigated participants reported the conceptions they hold about ideal classes, that is, their understanding of a good class. Three sub-categories emerged from the answers. Regarding the comprehension of scientific concepts, some statements: “A good class is that when students manage to understand the true chemistry concept” (IS 1). “Classes are interesting when they manage to involve the students and provide conditions for them to understand the contents” (IS 2). “A good class is one that shows reality and brings novelties” (IS 4). “Teacher didactic is essential to have a good class. Contents should be taught in such a way that students actually learn, not only memorize, because what is memorized is soon forgotten” (IS 5).

As to the use of experiments to teach chemistry, some manifestations: “Now that I have done experiments, I believe they help in comprehending the contents being studied” (IS 8). “A good class should first present the theory and soon after move to a practical lesson so students better comprehend the chemistry content” (IS 10). “Classes doing experiments to teach each chemical concept” (IS 11).

It can be perceived that the investigated participants do not consider practical lessons as investigative processes. From the above mentioned answers, it is assumed that practice only serves to prove theory. On the other hand, from IS 10 and IS 11 statements, it can be perceived that experimental classes should make a relation between concepts and practices, that is, reflect how important is the relation with daily life.

According to Santos & Nagashima (2017), practical lessons require more than decision by the teachers, that is, beyond the will to work this way, they must pursue the conditions for them to take place. In the authors view, when teachers offer practical activities in their classes they increase the possibilities for learning of the scientific contents to occur, since they allow for a closer view of the phenomenon being studied, which may help overcome eventual barriers against learning. This is reflected in the statements regarding the valuing of experimentation for content comprehension.

The investigated participants also associated the ideal class with the posture adopted by teachers that involves planning and utilization of diversified teaching strategies. Below are some manifestations: “A good class is one that has been well planned, that surprises students into being interested in the studies and, to attain such result, teachers must make an effort” (IS 3). “A good class has a beginning, a middle and

an end, that is, a well defined proposal. It is a fun, not tiring class because students like to get motivated and involved" (IS 4). "A good class requires planning and dedication, which requires time and knowing the students and the contents to be taught" (IS 7). "Having a good class depends highly on the teacher. When teachers know the contents they are capable of teaching in an easy way and explaining with confidence is better for students to understand" (IS 9).

It is worth pointing out that in the indigenous society education is a process that is not restricted solely to the physical school space, that is, the entire context within which the traditional community is inserted becomes educational spaces. Furthermore, the teacher figure is enacted by several players, that is, many persons play the role of transmitting knowledge to the younger ones. Within this context, the mother teaches and is considered to be a teacher, the father is a teacher, elders are teachers, the uncle is a teacher, the older brother is a teacher, the chief is a teacher (MAHER, 2006).

In the fourth and last category students reported on the contributions they attribute to chemistry towards people's lives. From the reports collected, three sub-categories also emerged. Regarding comprehension and conservation of nature, below are some contributions: "It contributes mainly because by learning chemistry we understand how to preserve and respect nature" (IS 3). "Chemistry studies allow us to take care of nature and the use of its materials" (IS 8). "People can comprehend that natural foods are better for the organism, as well as understanding that everything in nature is interconnected" (IS 10). "It teaches how to reuse and reduce the quantities of materials from nature and thus preserve it" (IS 11).

In studies by Maciel, Curi & Pereira (2013) it is possible to notice that the indigenous students bring multiple learnings with meaning in a laboratory called 'Nature', so theoretical classes taught by teachers with no direct relation to their lives become uninteresting.

As to people's quality of life, the statements corroborate this thought: "This knowledge leads people to avoid processed foods such as soda, sweets and others that are hazardous to health" (IS 2). "The knowledge of chemistry allowed for discoveries like vaccines that allow people to be protected against diseases" (IS 4). "Chemistry contributes greatly towards the evolution of medicine with the advancements of and improvements in medication" (IS 5). "Chemistry contributes to improving people's lives" (IS 6).

Regarding the presence of chemistry in daily life, some statements: "This knowledge is also in our daily lives, such as to light a fire, roast a fish, beat timbó and be painted with urucum" (IS 1). "Its presence is much greater than we imagine, as in the chicha, in the use of plants in traditional medicine and even in body paint" (IS 8). "Chemistry relates to life as a whole, from digestion to breathing they are chemical reactions that take place for life to continue" (IS 9).

These last statements show a considerable advancement over their perception of chemical science, since when choosing the images they did not relate the presence of chemistry in good things. It can also be perceived that the investigated participants understand nature as being fundamental and that they may extract from it what they need for their subsistence, they know how to produce technologies that make their lives easier to minimize efforts. This important piece of knowledge about the diversity of chemical substances present in nature and the technologies required for their extraction already occurs amongst the indigenous peoples, because:

[...] they know how to extract substances from plants by means of their own technology and thus manage to obtain medication, pain killers, medicinal oils and infusions, since it is the plants they have that contain the active principle of the pharmaceuticals that are used for all Brazilian citizens. They further extract perfumes, condiments and pigments of several colors, among which the urucum. It should be noted that each one of the 225 indigenous tribes distributed through Brazil has its own technology that allows for their survival in present times (MACIEL; CURI; PEREIRA, 2013, p. 346).

According to the official documents that guide indigenous education, a specificity of such teaching can be perceived, since for an indigenous person, education is in everything and includes what we are and have.

From the answers presented, a conceptual advancement can be perceived that was constructed along the subject, for in the choice of images (initial activity) the weakness was noticeable in correlating the concepts learned in school with those they found in nature. Lastly, it can already be perceived that the indigenous trainee students hold formed conceptions about different aspects of the concepts and how to teach them, which is ideal to be happening according to Afonso & Leite (2000).

As suggested by Predebon & Del Pino (2009), it becomes evident that the early chemistry teacher training courses provide moments to reflect upon the conceptions of this science and how to establish its teaching still during the training period, more so for it being specifically indigenous training.

Final Considerations

This text allowed to identify the conceptions those indigenous students from the Licentiate Degree Course on Mathematical and Natural Sciences at UNEMAT Indigenous College hold about the didactic-pedagogic aspects involved in the act of teaching chemistry. From the statements it is possible to perceive how much they learned during the course and how their views changed on this area of knowledge.

As to the indigenous trainees' concept/definition of a good class, they recalled the actions that led students to understand the scientific concepts being studied in the subject, the exploration of experimental activities in the classes and the planning of teachers who utilize diversified strategies to teach their classes, and contributions of chemistry to people's lives.

Regarding the contributions of chemistry to people's lives, the investigated participants mentioned that this science allows to understand nature, that chemistry is important since it is present in the daily life and that its advancements have a significant contribution towards life quality. Thus, this study revealed the conception those indigenous teachers hold about chemistry and the teaching of this subject and reinforced the importance of early training to construct the teacher identity.

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