


**GALENA RADIO IN GEOGRAPHY AS A DIDACTIC-PEDAGOGICAL RESOURCE IN TEACHING-LEARNING – LISTEN BEFORE IT DISAPPEARS** <https://doi.org/10.56238/sevened2024.037-095>**Érico Anderson de Oliveira<sup>1</sup> and Rosália Caldas Sanábio de Oliveira<sup>2</sup>.****ABSTRACT**

This report is from an experiment with Radio Galena in the classroom with students from the initial grades of technical courses at the Federal Center for Technological Education of Minas Gerais (CEFET-MG) in Belo Horizonte. The theoretical foundation was based on a constructivist practice that proposes the articulation of knowledge from the curriculum and the ability of students to elaborate their own concepts, exercising their skills and competences. The contents of Physics (waves, resonant circuit, electromagnetism and others) and Geography (location of transmission, distance of propagation, interference of geographical features, analysis of maps, mineral resources present in the components...) were involved. During the tests, the students were able to listen to the programming of an AM radio station and correlate their listening with the contents of Geography (scale, globalization, communications, areas of influence, scope, culture, wave propagation and interference – relief, vegetation, atmospheric conditions). The prototypes were subjected to different locations to analyze the interference of geographical elements. To the geographical contents, geopolitical, physical, economic discussions etc. were added. It was found that the various contents discussed were understood in the ways in which they are articulated both for the functioning of radio, the geographical limitations, as well as for the propagation of ideas or possibilities given by technological advancement in the present day and its interferences of all kinds.

**Keywords:** Geography Teaching. Technology. Multidisciplinary. Radio Galena. Globalization.

---

<sup>1</sup> Master in Geography Didactics - Professor of Geography at the Department of Geosciences - CEFET-MG.  
E-mail: [ericoliv@cefetmg.br](mailto:ericoliv@cefetmg.br)

LATTES: <http://lattes.cnpq.br/3460944236458367>

<sup>2</sup> Master in Geography Didactics - Geography Teacher at the Dep.de Geosciences - CEFET-MG.

E-mail: [rosasanabio@gmail.com](mailto:rosasanabio@gmail.com)

LATTES: <http://lattes.cnpq.br/7394233647698513>

## INTRODUCTION

This work deals with the use of a simple pedagogical material: the galena radio – an AM modulation radio receiver that can be elaborated with a few parts. It was worked in the classroom with the students of the Integrated High School of the Federal Center for Technological Education of Minas Gerais (CEFET-MG), Campus I, in Belo Horizonte. The predicates semiconductors of the mineral galena are used, hence its name, one of the non-metallic bodies that conduct electricity before in radiofusion.

Here, Galena radio is used as an educational resource for a greater altercation, its own obsolescence (?) and/or "radiomorphosis" as a<sup>3</sup> vehicle of popular communication and of what has historically been broadcast on its airwaves over the last decades, in the midst of the globalizing course, especially the cultural one.

In the face of today's overwhelming technologies of communication and information based on contemporary living, intrinsic apparatuses of this capitalist processing that imposes new ways of thinking that disaggregate others in the name of a brave new world, we ask ourselves: what will happen to radio as a tool for dialogue and democratic freedom of part of the Brazilian population?

Milton Santos (2001, p. 9) discusses a world seen by a deceptive perception: "We live in a confused and confusedly perceived world. (...) It is the way in which, on this material basis, human history is produced that is truly responsible for the creation of the tower of Babel in which our globalized era lives." We yearn to escape from this illusory "certainty", since: "Its foundations are information and its empire, which are based on the production of images and the imaginary, and are placed at the service of the empire of money, which is founded on the economization and monetization of social and personal life" (SANTOS, 2001, p. 9).

In Castells (2000), using Calderon and Lasema, in the universe in which globalization and fragmentation are concomitant, the heart of the question is: "How to combine new technologies and collective memory, universal science and community cultures, passion and reason? How, indeed! And why do we observe the opposite trend all over the world, that is, the growing distance between globalization and identity, between the Network and the Being?" (CALDERON and LASEMA *apud* CASTELLS, 2000, p. 58).

In any case, according to Kischinhevsky (2012, p. 421-422):

---

<sup>3</sup>"By radiomorphosis, radio radio is reconfigured in webradio and this means that the various formats will coexist for a long time to come, even if in different supports. But we have no doubt that the future of radio is digital, with transmission through the computer network that integrates the whole world" (PRATA, 2008, p. 220).

Radio, increasingly, is integrated into a process of media convergence, (...) on a planetary scale, in a period of transition to a post-Fordist economy. On the one hand, this convergence intensifies the business concentration around a handful of industrial conglomerates with interests in communication and culture, and on the other hand, it opens access to the market of symbolic goods to new actors, from small innovative companies to individuals, including social movements, non-governmental organizations, universities and other social actors previously deprived of their own means of communication.

There is no consensus among communication researchers regarding the use of certain meanings and approaches in studies of media development as a whole and radiophonics, sometimes they see the medium as an object, sometimes they discuss its specific characteristics: convergence, interaction, mediation, remediation (GARSON, 2019), (BOLTER and GRUSIN, 1999), radiomorphosis (PRATA, 2008), mediamorphosis (FIDLER, 1997), hypermedia...

Cebrián Herreros, in advance in 2001, referred to by Kischinhevsky (2012), exposed the demand for a new categorization.

The Internet opens the way to a new radio of oral and sound intercommunication between users in which the "emirec" model (sender-receiver) is developed with its complexity in which the hegemony of the sender is lost over the receiver and a situation of equality is generated between the speakers [...]. Hyperphonic and hypertextual idiomatic radio navigators are born. These are users who move from one station to another, who interrelate the sounds and who try to associate the broadcast texts with each other and with other sounds. (CEBRIÁN HERREROS apud KISCHINHEVSKY, 2012, p. 426)

It is a controversial subject, we will not have the answers immediately, because we are living in this historical time of great transformations and we do not have impartiality in opinions precisely because we live it now, but we can intuit about it. Despite this, the magnitude of radio in the past and in the present moment is undeniable, its social role since then and its ability to transmit music and all kinds of information in the globalized era, as well as its valuable connections with social networks and communities.

When the first radio experience took place in our country more than 100 years ago (in 1922), on the centenary of Brazil's Independence, the president at the time, Epitácio Pessoa, made an inaugural statement and his speech was heard by few receivers installed in Rio de Janeiro, the federal capital. Since that time, a lot has changed.

McLuhan (1972, p. 335), when relating art, expression and technology, speaks of "reversal and the 'current of consciousness' and the perception of the open 'field', which subverts all aspects of the discovery of the assembly line or the 'technique of invention' of the nineteenth century". To use G. H. Bantock in this regard:

In a world of increasing socialization, standardization, and uniformity, the goal was to accentuate the uniqueness, the purely personal in experience; in a world of "mechanical" rationality, the goal is to accentuate other ways in which human beings can express themselves, to see life as a series of emotional intensities, importing in a logic different from that of the rational world, and which can only be apprehended among dissociated images or in a stream of reflective states of consciousness. (BANTOCK apud MCLUHAN, 1972, p. 336)

We believe in the survival of radio because it is a communication equipment with resilience, facing different media for generations (TV, internet) and maintaining its public esteem and versatility, allowing one to see "life as a series of emotional intensities", rather than "mechanical rationality" (BANTOCK apud MCLUHAN, 1972, p. 336).

In fact, on the world wide web there is a type of radio with hertzian waves with a presence on the web and another type of radio with specific effectiveness on the internet called "webradios" (PRATA, 2008). But, still in agreement with Prata (2008, p. 29): "The most sensible thing is to realize that the convergent model is in the construction phase, with the old elements reconfiguring themselves in search of a framework in an absolutely new way of making radio".

Nowadays, this malleability is perceived since radios (FM) move together with other means of mass communication, notably the internet, promptly taking entertainment to anywhere in the globe, in addition to the technological translation from AM to FM radios, in displacement. That is:

on the internet, radio continues to be oral and the mental dialogue with the listener remains, but it is also textual and imagetic; It continues to be broadcast in the user's real-life time, but now has a worldwide reach and allows subsequent access to the streamed content. (...) WebRadio will gain autonomy, mobility and low cost. (PRATA, 2008, p. 223)

However, the choice of the manufacture of a galena radio and its implementation by the students within a well-placed planning and attached to other didactic devices have, as their primary purpose, the critical analysis of the current paradoxes of the neoliberal society through the contextualization of the radio as a means of communication in the planetary acculturation in succession, learning not only about its musical programming/news and its peculiarities, but also its area of achievement and its deterritorialization/reterritorialization, the expanding technological advancement, among other aspects.

In this multiplatform media environment, ML technology has aged and lost its ability to adapt to digital. Starting with the deterioration of mono sound quality, subject to interference and electrical noise during the transmission and reception process, making it difficult to tune in to desktop and mobile devices. Added to this is the decision of the cell phone industry to exclude the capture of the AM frequency from mobile devices since 2009, giving preference to FM. (SILVER; BIANCO, 2020, p. 26)

Thus, the didactic-pedagogical perspectives on radio and its functionality in the teaching-learning of Geography are copious, awakening the inclination and involvement of students in the geographic contents of High School in classes of the 1st year Integrated of CEFET-MG, in Belo Horizonte, in a transversal unfolding of reality, since the complexity of the world calls for an interdisciplinary approach of knowledge.

Based on Morin's comments on the relationship between complexity, reality and culture:

If homo sapiens has "surpassed" the strictly biological order by jointly developing culture, language, thought, consciousness, at the same time he has widened the sphere of life to culture, to language, to thought, to consciousness. What we need to understand is not culture excluding nature, it is not the spirit excluding the brain; on the contrary, we cannot understand our nature if we exclude our culture, our brain if we exclude our spirit; We need to conceive of the complex "uniduality" of our natural-cultural being, of our brain-spirit, our reality at once natural and metanatural, that is: cosmo-physical-bio-anthropo-sociological. (MORIN, 1995, p. 17-18)

## THEORETICAL FRAMEWORK

These domains alluded to early and structured with the curriculum, and a planning with well-agreed pedagogical intentions, contributed to the addition of abundant ingenuity demonstrated by the students in the prolongation of the activities, such as: disentanglement, commitment, help to the other colleague(s), organization, exchanges and ownership in what was shared, geographical and world syllogism, quality of argumentation in the face of what was investigated, analysis of the songs and information conveyed by the AM and FM of the Metropolitan Region of Belo Horizonte (RMBH) researched, the ways of representing knowledge (discourses, symbols, scales and maps), the subtlety of listening, etc.

The teaching-learning follow-up allowed the insertion of theory with practice and the interplay of various fields of knowledge. With Physics and Electrotechnics, for example, radio waves were discussed as a type of electromagnetic radiation that transmits energy with the characteristic of being non-ionizing, with high wave length, but of low frequency, and why they are used, especially in telecommunications. In addition to its attributes – amplitude, wavelength, frequency and speed – the differences between its most common forms were also highlighted: AM (amplitude modulation) and FM (frequency modulation).

Thus, AM radio has the benefits of propagating information to more stations in a marked frequency range and being readily distinguished by receivers. However, its signals are more subject to inconstancies of noise and static (when the electric charge present in a body has its atoms unstable in its neutrality), as during a thunderstorm. In this circumstance, noise peaks occur due to lightning strikes and this is immediately signaled by the AM tuners. Another factor to consider is that AM radio also has, unfortunately, a very circumscribed

audio coverage (from 200 Hz to 5 kHz) and, in terms of hearing, its signals have a lower quality than FM.

FM radio operates in a much wider frequency range than AM radio, although its range in terms of distance for its transmissions is less extensive than AM. However, in terms of vehicle for music, because it has a higher bandwidth range (from 30 Hz to 15 kHz), FM radio has excellent sound quality, however, due to these specificities, to cover a larger coverage surface, it needs additive transmitters to conduct its signals.

Therefore, multiple themes were articulated in this educational process, namely: principle of construction and purposes of telecommunications equipment, in particular radio; forms of generation, sensitization/calibration and adjustments of the devices; quality and scope/scale of transmissions; internal and external instrumental/technological factors (analog and digital systems, analog-to-digital converters – ADCs...); political and socio-environmental factors (interference of geographical features and natural phenomena/atmospheric conditions; use of mineral deposits – control and transformation of these resources and their use in communications systems; target audience reached by this medium – radio, the definitions of what is transmitted by each broadcaster, strategies and interests) etc.

Regarding the discipline of Geography, in addition to the topics mentioned above, radio was worked as a propagator of culture and maintenance of identities in history since its beginnings in the country (early twentieth century); the influences of the capitalist system through globalization on telecommunications and ways of life in contemporary times; the homogenization of a pseudo-individuality; the flexibility of radio in the face of technologies in historical time and its moment of transition in the present.

The educational practice presented, resulting from research on what education is and what is its meaning among peers, within a Basic Education research group of which we are part (Geopossible Research Group – CEFET-MG), arose from the authors' pressing conviction regarding the need to renew the daily exercise as educators, continuously questioning themselves in terms of curriculum, planning, practices, methodologies and possible results.

For this purpose, the philosopher Edgar Morin (1999) advocates a distended method, "without strings attached" and without certain answers, a space that will become visible only at the end, which, in turn, in view of the natural indeterminacies of this path, will provide a pedagogical emancipation of the teacher subsequent to his free will.



It should be remembered here that the word "method" does not mean methodology at all. Methodologies are a priori guides that program research, while the method derived from our path will be an aid to strategy [which will encompass, in a utilitarian way, programmed segments, that is, "methodologies", but will necessarily involve discovery and innovation]. (MORIN, 1999, p. 39)

Knowing that, historically, the school is exclusionary and elitist, because instead of welcoming the student it expels him, and that it is easier to blame the student, already marginalized, for his failure/evasion than for the system to courageously assume its responsibility (a system of which we are a part), we swim against the tide. And we ask ourselves: Aren't we part of this same oppressive and manipulative system with which we disagree so much? How do we position ourselves, then?

Consider, with Freire (1967, p. 21), that "no one in a democracy is excluded", because:

It is not enough for the people immersed in their secular silence to emerge giving voice to their demands. It must also become capable of elaborating its awareness in a critical and prospective way in order to overcome a behavior of rebellion for a responsible and active integration in a democracy to be made, in a collective and national development project. (FURTER In: FREIRE, 1967, p. 3)

With the debate aligned in the educational praxis focused on the teaching-learning of the discipline Geography, in the Integrated High School (1st years) of CEFET-MG, the educators, in this context, point out that more important than the contents studied in the set of tasks accomplished – although contextualized in a qualified perspective – is what underlies the practice and what was intended, that is, a humanizing view of what education is and the meaning of learning and teaching Geography.

There is an implicit social commitment to education, configured beyond the deceptive perspective of an instructionist education, with the stealthy propagation of knowledge that generates the alienation of the individual/student; Geography is not or should not be "a telephone directory".

Célestin Freinet, a French pedagogue, warns us when defining the difference between handlers and educators:

I am sorry for the educators who are only keepers and pretend to treat students methodically and scientifically, locked up in rooms where, fortunately, they spend only a few hours a day. Its great concern is to swallow the mass of knowledge that will fill engorged heads to indigestion and nausea. Their art is that of stuffing and conditioning, and also of medication capable of making the ingested notions assimilable. Preserve in your pupils the natural appetite. Let them choose the foods in the rich and propitious environment that you prepare for them. Then, you will be an educator. (FREINET, 2004, p. 39)

He further reasons about the value of an education in which:

Life is prepared by life. If you are afraid that your child will break his head, tear his clothes, get his hands dirty (...), lock him up (...) or take him by the leash (...), so that he does not join the bands of children who in the street, in the gardens, in the orchards and in the bush — fearlessly seek their elementary experiences.  
(FREINET, 2004, p. 23)

By correspondence, we are in a consecrated conjunction in which every practice is or should be a socio-affective exercise rich in observations, tests and educational experiments (WALLON, 1989); in which we would need to "make the sun shine" like "The adventurers of Kon-Tiki", who (...) they equipped their caravel and set out alone in the mysterious Pacific, to redo an experiment, verify a hypothesis and prove to the world that man has not degenerated, they are like a symbol of this conversion" (FREINET, 2004, p. 16-17). We must, in view of this, "experience" more in the classroom for our sanity and that of the students.

This pedagogical observation infers the return of affectivity to teaching, reinforcing, once again, what the school seems to have forgotten in recent times: that our students in Basic Education are children/young people in formation, "the study of the child is essentially the study of the phases that will make him an adult" (WALLON, 1989, p. 46). Wallon's indications in favor of education and this development, by the experimental method, go through investigations and the verification of parallelisms.

Subsequently, Wallon deepens his manifestos:

The study of correlations is therefore a method of analysis and verification, but not of reconstruction. (...) The existence of a set is not to be confused with the affinities of its parts. What makes the different activities that constitute it contribute to the behavior of a given age is not necessarily the fact that they are conditioned to each other. The causes of an evolution go beyond the present instant. Each of its stages cannot, therefore, form a closed system, the manifestations of which would all depend strictly on each other. (WALLON, 1989, p. 47)

This affectionate gaze will allow us to carry out our educational experiments for the benefit of our students. To do so, each teacher needs to know their students, their "biographical narratives" (BRUNER, 1997a; 1997b; 2001) and, in teaching, make the association feasible as opportunities arise, with the daily life of the individual/student and their interests/abilities, because the centrality is in the student (ROGERS, 2019).

In the appreciations of Jerome Bruner (1997b, p. 46), "a narrative is composed of a singular sequence of events, mental states, occurrences, involving human beings as characters or authors". It is apprehended as a metaphorical achievement constructed from a



historical-social point of view and culturally expressed, in which the subject who forges it exposes his representation of the proximate reality, conceiving and reformulating it in his narrative and life transit.

Furthermore, Bruner ratifies the understanding that each (auto)biographical narrative stands out in a peculiar panorama and its conformation is subordinated to the singularities of the enunciator and his dialoguers, all undoubtedly consigned to the same cultural core, having as essences the encounters of values and precepts incorporated in this sociocultural scenario (BRUNER, 1997b).

Apart from the current interlocution, it is necessary for the narrator to undertake a deep and particular intellectual work that encompasses the recollection of knowledge/memories/experiences of the past, appreciating them through a prism of what is more considerable in the present, probably receiving intercessions that act as an incitement to narration. This subjectivized extension of the being says that the narratives are neither finalized nor concluded, but are repeatedly open to new contributions and reelaborations (BRUNER, 1997b). Hence Bruner's invitation for schools to be communities of mutual learning:

In fact, based on what we have learned in recent years about human learning – that it is best if it is participatory, proactive, communal, cooperative and if it aims to construct meaning, rather than receive it – we do better in teaching science, mathematics and languages in these schools than in more traditional schools. (BRUNER, 1997a, p. 84)

Vygotsky, on the other hand, interprets the school as an environment in which students take possession of the universal heritage of humanity densified in the school curricula. Teaching-learning is a psychological mechanism that designates the psychic refinement of the young student. The teacher's conduct in this scope is to link the student's pre-existing practical knowledge with the theorizations that he will develop in school. In the Vygotskian bias, to deepen the theoretical and scientific conceptualizations in education is to place teaching in the area of proximate development, requiring relationships between the dynamics of teaching, learning and the improvement of the psyche (VYGOTSKY, 1989).

Combining the learning of the school with that of the student's life is a constant desire for every teacher, because the school is not detached from culture, on the contrary, it is one of its expressions. Immersed in a complex universality, we see the world of today through our partialities and our localities, and the gaps in knowledge are cognitively complemented through interactions, preferably. The biggest question, in our praxis, is not to let ourselves be imprisoned in the search for a range of themes, but to emphasize the deepening of what

we consider important for the student to abstract, so that he can later internalize them and, later, reinterpret them in his own way, creating his own judgments.

Our principles are based on the assumptions of Geography, on education scholars that we deeply admire and with whom we have more affinities, some of which are mentioned here and in classroom experiences; however, these studies that refer to us are not unquestionable axioms. The theoretical foundation is respectable, but the difference is in the sensitivity and intuition in relation to our students.

We believe that, thanks to quality education, we can build, in the future, a more humane and democratic society, as Santos (2001, p. 11):

On the theoretical level, what we see is the possibility of producing a new discourse, a new metanarrative, a new grand narrative. This new discourse gains relevance due to the fact that, for the first time in the history of man, the existence of an empirical universality can be verified. Universality ceases to be just an abstract elaboration in the minds of philosophers to result from the ordinary experience of each man. In such a way, in a dated world like ours, the explanation of what happened can be made from categories of a concrete history. It is also this that allows us to know the existing possibilities and write a new story.

Therefore, the work in the classroom, in the discipline of Geography, has as an anticipated conjecture to help the student to arrive at a presumed "geographical reasoning"; by doing so with our mediation, if it happens, he will establish himself as a subject/citizen. However, there are no prerogatives.

## METHODOLOGY

Access to a competent and popular school, ingrained in our cultural and massifying civilizing process, reinforces that democratization occurs/will take place with the evolution and overcoming of our intrinsic contradictions, on the part of all those involved in the educational system, thus, our work as educators is eminently political (not to be confused with "pamphleteering").

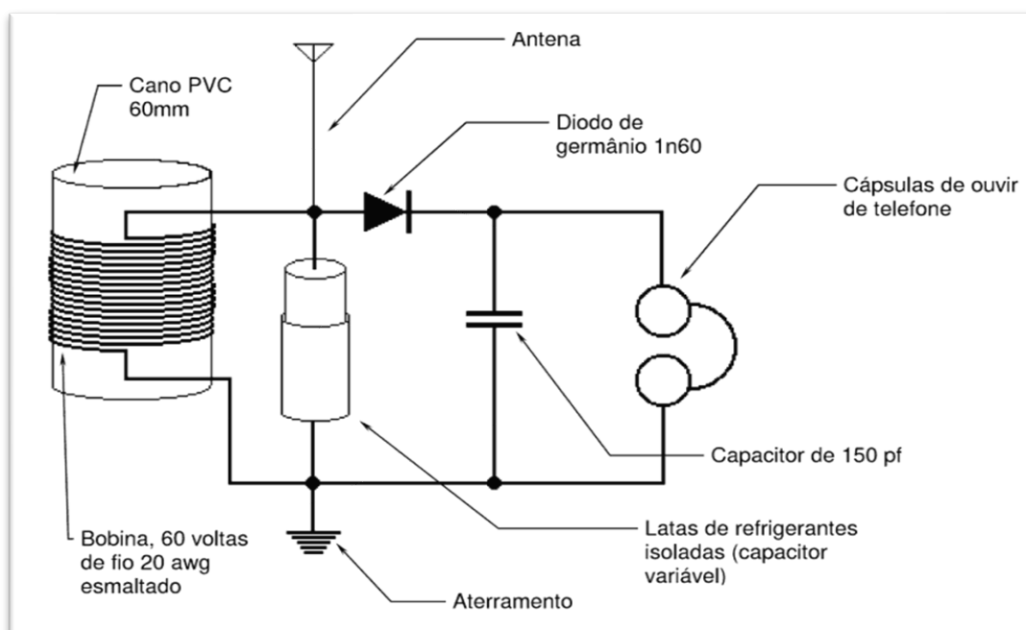
Therefore, this methodology was listed in the problematization of the focus of study (globalization) in Basic Education, collecting the theoretical elements inherent to the exposed practice and its pertinences in the concreteness of the classroom from the knowledge about the students, the generation of knowledge and assumptions elaborated by them, in a formative geographical practice.

Let us see, below, the methodological steps taken (within an open method):

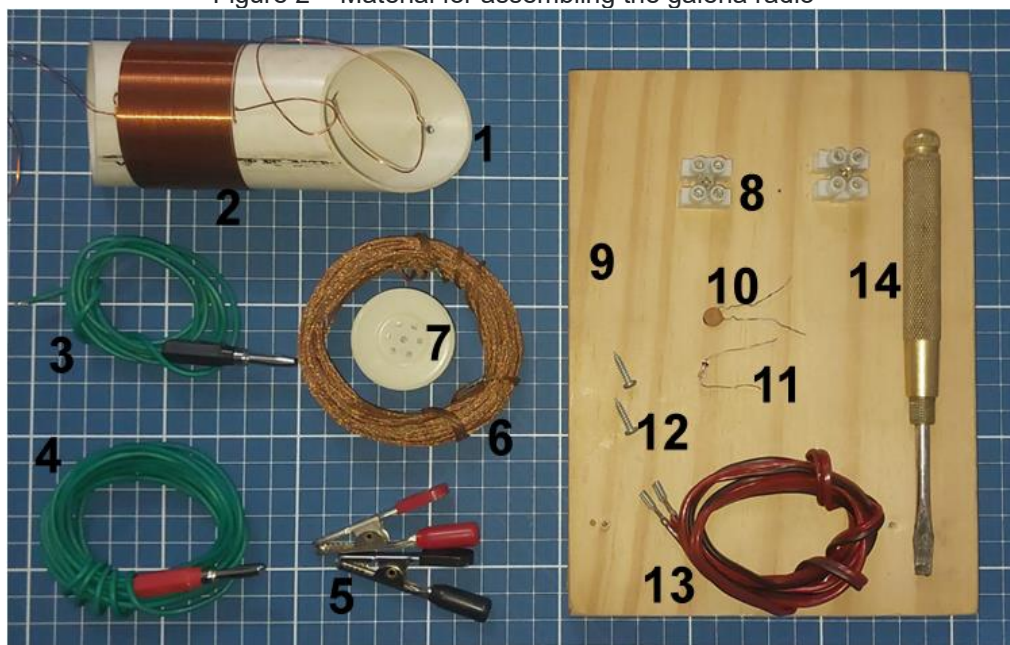
- i. Diagnostic evaluation of primary notions (globalization, fragmentation, identity, diversity, multiculturalism, ideology, hegemonic power...), planning of activities;

- ii. Research done by students on new technologies in telecommunications, especially on radio and its history in Brazil, its new configurations;
- iii. Individual survey on the main AM and FM radios in the Metropolitan Region of Belo Horizonte and their relevant characteristics (which songs/information/news they broadcast and by what means, target audience, etc.);
- iv. Radios tuned by students and their families, identification and particularities;
- v. Discussion in groups for the exchange of experiences and information among students with the interposition of teachers;
- vi. Preliminary explanations for the manufacture of the galena radios, an electronic scheme made available to the students (Figure 1).
- vii. Materials needed for the assembly of the galena radios in the room (Figure 2) were:
  - a. Electronic scheme; 1 board of 15cm x 20cm;
  - b. 1 coil of 60 turns of 20 AWG enameled wire (0.8mm diameter);
  - c. 4m of 24 wire (cabin) for connection with antenna and with connection for grounding;
  - d. 2 large alligator clips with insulation; 5m to 10m of wire rope for antenna;
  - e. 4 screws (1.5cm) for wood; 1 capacitor from 150pf to 470pf ceramic or stiroflex;
  - f. 1 germanium detector diode 1n60, AA119 or equivalent;
  - g. 1 variable capacitor of 410pf or 2 cans of soft drinks interspersed with plastic insulating them;
  - h. 1m of polarized parallel wire for speaker;
  - i. 1 earphone capsule (listen) of the highest possible impedance;
  - j. 1 small screwdriver; 2 banana plugs;
  - k. 2 pairs of parafuso (sindal) bar connectors from 1.5mm to 2.5mm.

Figure 1 – Electronic schematic of the galena radio



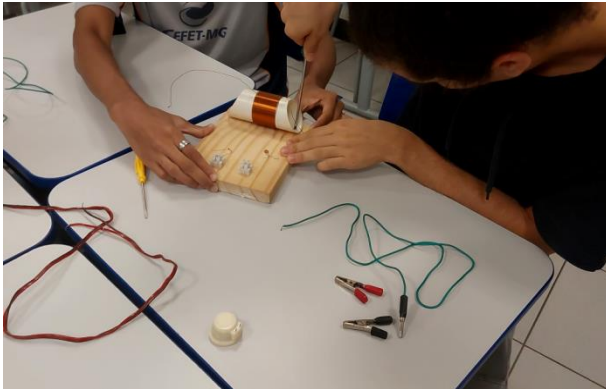
Source: Prepared by the authors.  
Figure 2 – Material for assembling the galena radio



Source: Authors' collection. Description: 1 – PVC pipe, 2 – Enamelled wire coil, 3 – Grounding wire, 4 – Antenna connection wire, 5 – Alligator clips, 6 – Antenna cord, 7 – Headphone capsule, 8 – Sindal connectors, 9 – Wooden plate, 10 – Ceramic capacitor, 11 – Germanium diode, 12 – Screws, 13 – Headphone cable, 14 – Screwdriver.

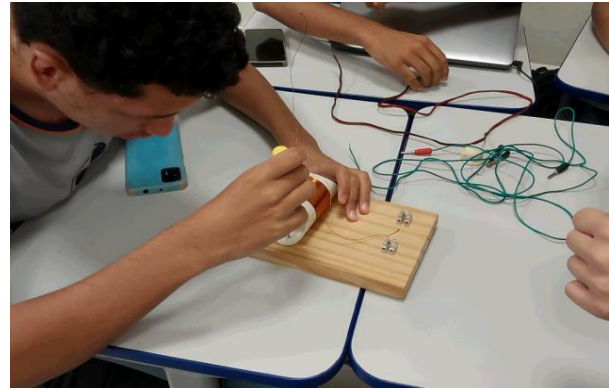
- viii. Assembly of the galena radios in the classroom (Figures 3 and 4) and prototype completed with the suppression of the variable capacitor (Figure 5).

Figure 3 – Assembly of the Galena radios in the classroom



Source: Authors' collection.

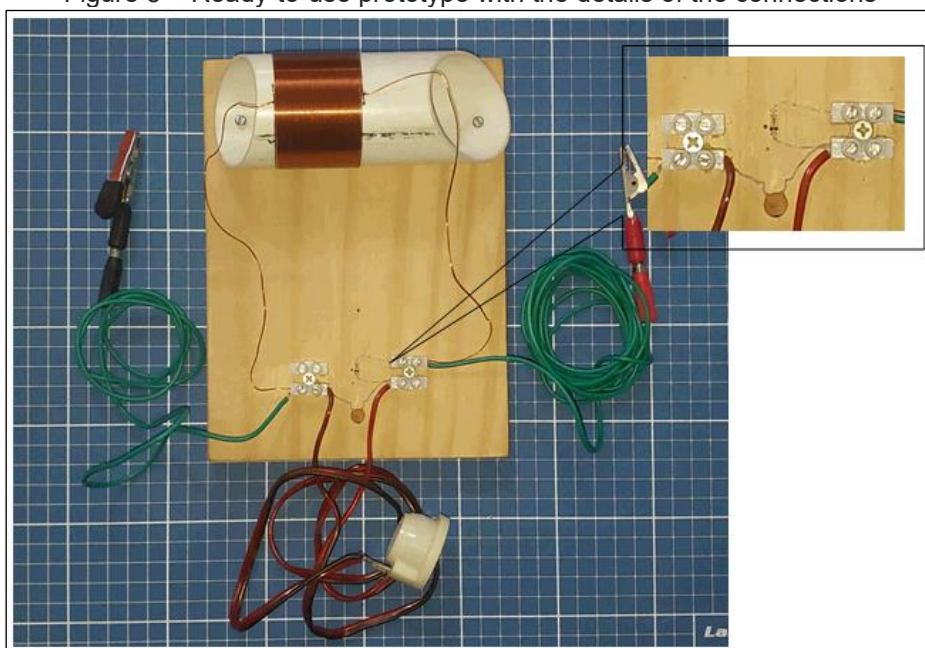
Figure 4 – Assembly of the Galena radios in the classroom



Source: Authors' collection.



Figure 5 – Ready-to-use prototype with the details of the connections



Source: Authors' collection

ix. Explanation of how to use the material to assemble the radio:

For the proper functioning of the galena radio, a good grounding and a good antenna are required. To make a good grounding, we can use some metal grid or metal pole that is stuck in the ground. The black alligator clip can be used to facilitate the connection of the grounding wire to the hardware.

The antenna can be made from a long wire (about 10m) stretched outdoors and with the ends insulated so as not to touch any metallic object that is grounded. The red alligator clip should be attached to the antenna wire somewhere it is bare. The antenna should be stretched and kept as far away from the ground as possible. The strand is the best material for the construction of the antenna, but a stretched extension wire will also work very well, just by placing the alligator clip on a bare end of the extension.

Since the variable capacitor is a more expensive part, it was suppressed from assembly. It is the capacitor that will allow the radio stations to change, but this can be achieved by reducing or increasing the amount of coil turns. Usually, the AM radio station that has a stronger signal is the one that will predominate in the auditions.

To simulate a homemade variable capacitor, we can use two aluminum soda cans assembled as follows: a can must be covered with a thick plastic such as PET bottle plastic, an X-ray sheet, plastic sheet (acetate) for transparency, or something similar to insulate it. The other can should have its bottom removed and made a longitudinal cut so that it can



wrap around the first can. The tabs (opener ring) can be connected to wires which, in turn, will each be attached to the ends of the coil.

Thus, to vary the capacitor, it is enough to pull one of the cans like a piston so that the contact area between them is changed, thus obtaining the effect of variation of a capacitor. We recommend that the second can, the one that will wrap the first, be secured by an elastic band to keep it as adjusted as possible to this first can and also so that it is the part that will be attached to the coil that will be grounded, as shown below (Figure 6).

Figure 6 – Improved capacitor with soda can: a) open, b) closed and c) installed on the radio



Source: Authors' collection.

The open capacitor has a lower capacitance value. As it is closed, the capacitance increases. This variation of the capacitor in conjunction with the coil will change the resonance point of the assembly, which will change the equilibrium point for each radio station frequency. This effect will allow a selection of the stations. The success of this piece will depend on how much one can will be adjusted over the other and the efficiency of the insulator between them.

- x. Tests inside and outside the classroom with Galena radios, conclusions from the experiments made;
- xi. Listening and analysis of the song "Banda Larga cordel", by Gilberto Gil (Table 1).

Table 1 – Lyrics of the song "Banda Larga cordel"

Long Band (Gilberto Gil)	
<p>He put it in his mouth, tasted it, spit it out It's bitter, he doesn't know what he lost It tastes like gall, bitter root Who doesn't come in the cord of broadband He's going to live without knowing what world is his</p>	<p>Devil of a little boy internet Alone he discovers the way The radio did the same with his grandfather Highway, waterway, railway And now arriving at the infovia For the joy of the whole countryside</p>
<p>Everyone in the broad discussion The neuroscientist, the economist Opinion of someone who is on the track Opinion of someone off the list Opinion of someone who says no</p>	<p>My Brazil, my very Brazilian Brazil YouTube coming to its grotes Paths of the hinterland, Guimarães Rosalíadas, Lusíadas, Camões King Solomon in the Upper Solimões The foot of the plant, the drool of the aloe</p>
<p>One band is good, it's umbanda Another band of the band is Christian Another band of the band is kabala Another band of the band is Koran And</p>	<p>He put it in his mouth, tasted it, spit it out It's bitter, he doesn't know what he lost It's bitter the mission, bitter root Who's going to release a</p>

<p>then, and then, how many bands? As many as my heart asks</p> <p>And my heart asked like this, justBim-good, bim-bim-good, bim-good, bim-bim-goodBim-good, bim-bim-good, bim-good</p> <p>Either this band expands and the band movesFaster to the bands of the hinterlandOr else no, it's no useBanda goes, the band is abandonedLeft for another incarnation</p> <p>Rio Grande do Sul, GermaniaAfrican-Amerindian MaranhãoMore democratized broadbandOr not, it's no useThe problems will have no solution</p> <p>Piraí, Piraí, PiraíPiraí has gone a little widenPiraí has made it possibleThe air of the entire municipalityCertainly the measure provokedA certain whirlwind</p> <p>Devil of a boy now wantsAn ipod and a brand new computerWhat is certain is that the hinterland wants to become the seaWhat is certain is that the hinterland wants to navigateOn the boy's computer little internet.</p> <p>Grandson from Bahia, a good singerA long time ago he became a provider, an access providerTo the great network wwwThis boy still becomes a wise manHired by Google, yes sir</p>	<p>balloon on broadbandIt's someone who hasn't been born yet</p> <p>The mission is bitter, bitter rootWho will release a balloon in broadbandIt's someone who hasn't been born yet</p> <p>Put it in your mouth, tasted it, spit it outBitter, you don't know what you lost</p> <p>The whole world in the broad discussionThe neuroscientist, the economist</p> <p>Or this band is widened and the band moves faster to the backlands</p> <p>Devil of a boy now wantsAn ipod and a brand new computer</p> <p>Netinho from Bahia, a good singerA long time ago he became a providerTo the great network www, from the great network wwwThis boy still becomes a wise manHired by Google, yes sir</p> <p>Devil of a little boy internetAlone he discovers the wayThe radio did the same with his grandfatherHighway, waterway, railwayAnd now arriving at the infoviaFor the joy of the whole countryside</p> <p>He put it in his mouth, tasted it, spit it outIt's bitter, he doesn't know what he lostPut it in his mouth, he tasted it, he spit it outBitter, he doesn't know what he lostHe put it in his mouth, he tasted it, he spit it outBitter...</p>
---	---

Source: Musicmatch, 2023.

- xii. Debate on the ongoing globalization process, new technologies and impacts on the populations' ways of life, what are the repercussions on culture and what interests they serve.

**NOTE:** This radio was executed in the form of a kit so that its assembly by the students would not require a lot of time and everyone could do it calmly, regardless of preexisting skills. The coil and cables were already made, as well as the connectors that were already attached to the wooden board. Alligator clips and "banana" plugs can be suppressed. The parts are low cost, with the exception of the variable capacitor. In this case, it was decided to make a homemade capacitor with two cans of soft drinks.

The use of the galena radio inside the classroom will suffer great interference from the electrical circuits of lighting, devices and the barrier represented by the walls and ceiling with their hardware. A much stronger signal can be obtained with the galena radio operated outdoors, suffering interference from nearby buildings, vegetation, relief and other elements

of the environment. The change of galena radio in varied environments will determine the best conditions for capturing AM stations. It is also recommended that the teacher, before applying this experiment in the classroom, assemble his radio at home and do his tests preliminarily, more than once if he deems it necessary, to avoid inconvenient surprises during the classroom laboratories.

## RESULTS AND DISCUSSIONS

The students' first impression was one of incredulity: how would such a simple apparatus be able to tune in to any radio? This feeling turned into a great surprise when the first tests were made with the radios already assembled. The stations were captured and the sounds came out clear on the headphones.

The didactic-pedagogical approach favored opportunities for not only individualized but also collective studies, referring to the history and constitutive data of the radio medium in general and in the country, and also to media creation and its apparatuses.

In addition to the deepening of the terms worked on in an interdisciplinary suggestion, distinctive areas of knowledge were made to assimilate what globalization and the means of communication are, the radio and its mechanics, its social/economic/political practices, the ways of structuring the medium, the value for freedom of expression and access to knowledge by the collectivity, among other approaches.

The debates and the making of Galena radios in the classroom led to greater interaction between students, helping each other, in a dialectical construction of discernments. They also provided communication with their family members from different generations by investigating the influence of radio in their lives and in other times; their preferences in the past and in the present and in what type of radio.

The students got involved in the activities and understood their purposes, issuing "tuned" opinions on the topics researched, as well as having the autonomy to investigate and interpret the media in a hypermedia world. They expanded their fields of vision, embracing argumentative positions in the face of the information collected, transforming it into knowledge.

## FINAL CONSIDERATIONS

The essay on the theme of globalization as a curricular part in a teaching with the objective of presenting its more in-depth conjuncture was a nod to the simple and to a significant praxis, with the perception that the path is inconstant and flexible, since the

production of meanings happens in the very walk towards an educational practice thought of the student.

At the end of the activities, we were able to verify that they were successful. The students expressed that they liked both the theme and the way it was developed and experienced, although with some unforeseen events that were normal during the tests with the Galena radio which, in turn, generated other analyses.

The purpose of the works was the assimilation and deepening of the globalization theme through a personal and collective "laboratory", having as motivation the making of a galena radio, making the equivalences between technological advancement, acculturation and the homogenization of planetary customs, the modifications in this means of communication and the lives of the students.

Also reflecting on the network society and its flows, how these means of communication interfere in our human grouping and at what levels (personal, local, regional, global), which "is in the process of structural transformation (...). It is a multidimensional process, but it is associated with the emergence of a new technological paradigm, based on communication and information technologies" (CASTELLS, 2000, p. 16).

However, within the educational process and in our private actions as subjects, we need to understand the changes underway in contemporaneity. At this level of schooling, in Integrated High School, students have a very large maturity and access to information, but with enough discernment to carry out their own contextualizations with the help of their teachers.

One of them is that: "We know that technology does not determine society: it is society. Society is the one that shapes technology according to the needs, values and interests of the people who use the technologies" (CASTELLS, 2000, p. 16). As an example, we have Marshall McLuhan (1964) alluding to the relevance of radio with the verses of the German playwright and poet Eugen Bertholt Brecht:

Little box I carried when on the run  
 So that your valves wouldn't break down,  
 That I took from home to the ship and the train  
 So that my enemies would keep talking to me  
 Near my bed, and to my anguish,  
 The last words of the night and the first words of the morning  
 About your victories and about my problems  
 "Promise me not to be suddenly mute."  
 (BRECHT *apud* MCLUHAN, 1964, p. 335)

That radio does not remain silent and remains diverse, and that, as subjects of a transforming social body, we are always aware of the social uses and consequences of

these technologies in our lives, with the identification of their ideological discourses and political interests, how we use them on a daily basis and how they promote integration and/or segregation among individuals where we live and around the world.

Thus, if we believe in another type of society and another type of globalization, and if we want change, the movement must begin with ourselves as educators, our praxis will be the result of this. On the other hand, that they actually contribute to the students having a voice and that the experiences are penetrated dialogical educational possibilities, as this one with the construction of the Galena radios.

## REFERENCES

1. Bolter, Jay David, & Grusin, Richard. (1999). *Remediation: Understanding new media*. Cambridge: MIT Press.
2. Bruner, Jerome Seymour. (1997a). *Atos de Significação*. Porto Alegre: Artes Médicas.
3. Bruner, Jerome Seymour. (1997b). *Realidade mental, mundos possíveis*. Porto Alegre: Artes Médicas.
4. Bruner, Jerome Seymour. (2001). *A Cultura da Educação*. Porto Alegre: Artes Médicas.
5. Castells, Manuel. (2000). *A sociedade em rede (A era da informação: economia, sociedade e cultura, v. 1)*. São Paulo: Paz e Terra.
6. Cebrián Herreros, Mariano. (2001). *La radio en la convergencia multimedia*. Barcelona: Gedisa.
7. Fidler, Roger. (1997). *Mediamorphosis – Understanding New Media*. Pine Forge Press, A Sage Publications Company. Thousand Oaks, California. Available at: [https://books.google.com.br/books?id=Y2gcG1qCFFoC&pg=PA83&hl=pt-BR&source=gbs\\_selected\\_pages&cad=2#v=onepage&q&f=false](https://books.google.com.br/books?id=Y2gcG1qCFFoC&pg=PA83&hl=pt-BR&source=gbs_selected_pages&cad=2#v=onepage&q&f=false). Accessed on: July 25, 2023.
8. Freinet, Célestin. (2004). *Pedagogia do Bom Senso (Psicologia e Pedagogia)*. São Paulo: Martins Fontes.
9. Freire, Paulo. (1967). *Educação como Prática da Liberdade*. Rio de Janeiro: Editora Paz e Terra Ltda.
10. Garson, Marcelo. (2019). The concept of convergence and its pitfalls. *Galaxia* (São Paulo, on-line), 40, 57-70. Available at: <http://dx.doi.org/10.1590/1982-25542019135324>. Accessed on: July 27, 2023.
11. Gil, Gilberto. (2008). *Banda Larga Cordel*. Record Label: Warner. Album: Banda Larga Cordel. Available at: <https://www.musixmatch.com/pt/letras/Gilberto-Gil/Banda-larga-cordel>. Accessed on: May 25, 2023.
12. Heyerdahl, Thor. (2013). *A expedição Kon-Tiki*. Rio de Janeiro: José Olympio.
13. Kischinhevsky, Marcelo. (2012). Social radio: mapping new sound interaction practices. *Revista FAMECOS – mídia, cultura e tecnologia*, 19(2), 410-437, May/August. Available at: <https://revistaseletronicas.pucrs.br/ojs/index.php/revistafamecos/article/view/12323>. Accessed on: July 24, 2023.
14. McLuhan, Marshall. (1964). *Os Meios de Comunicação como Extensões do Homem*. São Paulo: Editora Cultrix.
15. McLuhan, Marshall. (1972). *A Galáxia de Gutenberg – A Formação do Homem Tipográfico*. São Paulo: Editora Nacional, Editora da USP.



16. Morin, Edgar. (1995). La Relación Ántropo-bio-cósmica. *Gazeta de Antropología*, 11. Text 11-01. Available at: [https://www.ugr.es/~pwlac/G11\\_01Edgar\\_Morin.html](https://www.ugr.es/~pwlac/G11_01Edgar_Morin.html). Accessed on: July 25, 2023.
17. Morin, Edgar. (1999). *O Método 3: Conhecimento do Conhecimento*. Porto Alegre: Sulina.
18. Prata, Nair Moreira Martins. (2008). *Webradio: Novos Gêneros, Novas Formas de Interação*. Thesis, Postgraduate Program in Linguistics, Faculty of Letters, Federal University of Minas Gerais. Available at: [https://repositorio.ufmg.br/bitstream/1843/AIRR-7DDJD8/1/nair\\_prata\\_tese.pdf](https://repositorio.ufmg.br/bitstream/1843/AIRR-7DDJD8/1/nair_prata_tese.pdf). Accessed on: July 27, 2023.
19. Prata, Nair Moreira Martins, & Del Bianco, Nelia R. (2020). Innovation in tradition: the migration from AM to FM as a factor in the renewal of Brazilian radio. *Estudos em Jornalismo e Mídia*, 17(2). Available at: <https://periodicos.ufsc.br/index.php/jornalismo/article/download/68238/44859/284992>. Accessed on: July 26, 2023.
20. Rogers, Carl Ransom. (2019). *Tornar-se pessoa*. São Paulo: WMF Martins Fontes.
21. Santos, Milton. (2001). *Por uma outra globalização: do pensamento único à consciência universal*. Rio de Janeiro: Record.
22. Vygotsky, Lev Semionovitch. (1989). *A Formação Social da Mente*. São Paulo: Editora Martins Fontes.
23. Wallon, Henri Paul Hyacinthe. (1989). *As origens do pensamento na criança*. São Paulo: Manole.

NOTE: Paper presented at the IX Conedu, included in its annals.