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THE USE OF THE LANDSCAPAR APP AS A PEDAGOGICAL RESOURCE FOR TEACHING GEOGRAPHY

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Abstract: Linking the new technologies already used ostensibly by students in favor of meaningful learning is a challenge for every teacher and a pedagogical asset. The theoretical foundation was based on the precepts of Ausubel, Vygotsky and Piaget. The LandscapAR application converts a representation of contour lines into rendered 3D images. The main objective was to check the students' understanding of the study of terrestrial relief and, in particular, contour lines. The content had been worked on previously with students in Geography, with 10 1st year high school classes at CEFET-MG, in Belo Horizonte (MG). The activity with LandscapAR complemented the discussions, broadening the students' curiosity and making the cell phone a partner in the teaching-learning process.
Keywords: Meaningful Learning; Geography; LandscapAR; Technology.

INTRODUCTION

There is a Geography that is full of dynamism in everyday life, with infinite possibilities and potential that must be discovered, but what are the reasons that prevent it from being presented in the classroom? The lack of interest in the classroom on the part of students is due to a separation between the Geography that is studied at school and the real Geography that students experience in their daily lives.

After analyzing the situation at school, the majority of whom are passive and unmotivated when it comes to studying Geography, we came up with a proposal to use alternative practices and materials that, together with play, games and joy, can reverse this situation, making Geography simple (which doesn't mean superficial) and accessible to all students.

The LandscapAR application is simple, lightweight software designed to simulate relief from a contour representation. It was created by *Weekend Labs UG.* The program runs on the Android operating system from version 2.3.2 and is 2.5MB in size. The software can be obtained free of charge from mobile application repositories and is very simple and quick to install. It uses the phone's own resources, in this case the camera, to digitize a relief representation in contour lines, process it and then convert it into a rendered three-dimensional presentation of the relief.

The activity with the LandscapAR application is one of the proposals prepared within this didactic line, with an unpretentious strategy to stimulate students in their quest to deepen their geographical knowledge and the new knowledge they will acquire after carrying out the tasks, once they are able to make the possible connections. These strategies - duly planned - each within a specific didactic-pedagogical context, were called "Possible Geography" as a whole.

By preparing them, we end up questioning the way in which knowledge is elaborated, operationalized, which acquires a social character in the formal and informal daily action of the student and part of the teacher, converting the act of learning into something efficient and pleasurable. If the teaching-learning process is facilitated by proposals for action, these will lead the student to take ownership of geographical knowledge, experiencing and living their school practice, and becoming a person capable of using the set of skills acquired in their life. According to Morin,

> If we don't have the historical and geographical knowledge to contextualize, every time a new event comes along that makes us discover an unknown region, such as Kosovo, Timor or Sierra Leone, we don't understand anything. Therefore, teaching by subject, fragmented and divided, prevents the mind's natural ability to contextualize, and it is this ability that must be stimulated and developed by teaching to link the parts to the whole and the whole to the parts. Pascal said, back in the 17th century, and it still holds true: "You can't know the parts without knowing the whole, nor can you know the whole without knowing the parts". (Morin, 2002, p.4)

The authors' desire stems from the need for teaching practices to work in the student's favor, creating links with them, and for the student to identify with the subject. In order to do this, their experiences must be recognized and they must be able to become a way forward in the construction of a continuous process of understanding things, in which the result achieved has meaning and which allows for the development of a systematized knowledge of the subject.

Correspondingly, it is necessary to use different didactic proposals at school, in the teaching of Geography, that create identities between the experiences of the student and the teacher, school knowledge, the senses, culture, the arts and other forms of expression, so that the student has a rich and multiple vision of themselves, of Geography and of the world.

The evolution of learning, in this reasoning, is also a social process that develops through the reciprocal stimulation of processes, both individual and collective, of thought and the body. The ability to use a variety of resources at school humanizes education - since the focus comes from the student's interest, strengthening the affective, emotional and joy aspects and all that can make it more malleable, within a universe that is still very traditional. According to Severino (2006, p. 2),

> My idea of formation is therefore that of achieving a way of being, through becoming, a way of being that would be characterized by an existential quality marked by the maximum possible emancipation, by the condition of an autonomous subject. A situation of full humanity. Education is not just an institutional and instructional process, its visible side, but fundamentally a formative investment in the human being, whether in the particularity of the personal pedagogical relationship or in the context of the collective social relationship.

Therefore, one of the school's roles is to get students to understand the universe in which they live, allowing them to make comparisons between what they experience and what they perceive of reality, helping them to become more observant and critical people.

By practicing the use of new technologies, we can reinforce and achieve more meaningful learning for everyone.

Using new technologies to incorporate them into school content is a way of connecting and interacting with the new generation that also makes up this intensely globalized and technological school world. The challenge is to make the use of these tools and the analysis of part of this avalanche of information that society has before it, in special circumstances, become skills and have an essence.

New technologies are rapidly being added to people's lives, so that we can no longer imagine a society without, among other resources, the *Internet*, cell phones*, streaming, Bluetooth, WIFI*, personal computers and network communication, making everyone part of an "information and communication society". These resources are also found in classrooms.

Using these media for and with a generation of students who naturally capture, digitize, transform and live with texts, videos, sounds, images and digital information of all kinds can be useful and timely. If used with well-defined educational purposes, they are effective in promoting interactivity between students and helping in the teaching-learning process. Machado (2010, p. 43) confirms this when he says,

> In this sense, we have come to the conclusion that, while cell phones should be restricted in use in schools, both to allow for better teaching and to "disconnect" students a little from the frenetic pace in which we live, it is possible to make this equipment, so popular and accessible, an element of educational work by creating projects that include it as a research and production tool. So let it be!

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In fact, the educator is being put to the test, and Prensky explains the situation as follows:

> Today's teachers have to learn to communicate in the language and style of their students. This doesn't mean changing the meaning of what's important, or good thinking skills. But it does mean going faster, less step-by-step, more in parallel, with more random access, among other things. Educators may ask "But how do we teach logic in this way?" As long as it's not immediately clear, we should imagine." (Prensky, 2001, p. 4)

In addition, you have to test and take risks.

OBJECTIVES

GENERAL OBJECTIVE

The aim of the work is to help students' teaching and learning through practices that encourage their interest in the content of Geography classes, generating a sympathetic relationship with the subject and a perception of its importance for understanding the world.

SPECIFIC OBJECTIVES

The aim is for students to be able to carry out activities with the application:

a) Understand the use of contour lines to represent relief;

b) Build your own relief models from your contour sketches;

c) Carry out targeting in different positions to support the analysis of relief profiles;

d) Use the application as a tool to support the study of relief representation, its shapes and characteristics.

Technologies can positively involve people by promoting fascination with the new, at first, and secondly, when they provide insight into something, in other words, they lead to knowledge.

Moran elaborates on the countless forms of knowledge that exist, one of which is knowledge created through the media, and criticizes the teaching of content, proposing a school that is "open to society" and an education that takes into account the ethical, emotional and entrepreneurial dimensions. He goes on to say about the educator: "the good educator is an optimist, without being 'naïve', he manages to 'awaken', stimulate, encourage the best qualities in each person." (Moran, 2007, p.81).

So, in order to stimulate, educators need to master the knowledge required to use the tools and technologies available, in order to formulate activities that encourage students to relate to the content of their lessons. According to Moran (2007), the initial changes are of a peripheral nature, with technologies supporting learning until, later on, there are innovative transformations in curricular organization and in the way education is viewed.

It also deals with a technological character of a humanistic nature that should be present in schools, together with skills: "the more technologies advance, the more education needs human, evolved, competent, ethical people" (Moran, 2007, p.167).

The proposal is to add digital technology to the educational work, in the most usual way possible, giving more versatility to the practices, in this case, in a first experience - through the LandscapAr application, which increased attention and attraction to the content of the Geography subject - and to associate it with a theoretical-methodological foundation that will give it direction through the assumptions of David Ausubel, Jean Piaget and Lev Vygotsky.

Piaget's aim is to demonstrate how understanding about something is born and how it develops through interactions, explaining the beginning and evolution of knowledge as a set of correlations, building an explanatory framework for interactionist theory. When

students adapt to different situations, they use their actions as a means of achieving results that are quickly absorbed mentally.

Intelligence, then, is expressed on various levels and takes place in a process that allows it to present itself in different forms, and its particularities vary according to the progress and degrees made by the individual. Thus, knowledge and intelligence become richer and more complex in proportion to the individual's greater understanding and perception of the world.

In order to use the app, students need to understand it, train themselves to use it correctly, and then put their new knowledge into practice and solve the questions that have been proposed, as in the case described here. The app is just a pedagogical "vehicle", knowledge doesn't come from it, it just passes through it, and according to David Ausubel, the material used must be "significant", enough to challenge the student. They must have some prerequisites, know part of the content given through studies, experiences, explorations, so that, when they relate to this material, they can incorporate it more intensely - what David Ausubel defines as "meaningful learning".

Complementary material was also prepared for the practice, with each group doing it at the same time as using the LandscapAR application. In line with Ausubel's ideas, Moreira and Masini explain how this material should be prepared by the teacher:

> Introductory material presented before the material to be learned, but at a higher level of generality, inclusiveness and abstraction than the material itself and explicitly related to the relevant ideas in the cognitive structure and the learning task. It is designed to facilitate meaningful learning by acting as a bridge between what the learner already knows and what they need to know in order to learn the new material in a meaningful way. It is a kind of cognitive bridge (Moreira; Masini, 1982, p. 103).

Ausubel calls these materials "prior organizers".

Games, play and playful activities and their development, especially those that stimulate the student's curiosity or promote the development of imaginary situations and imitation, are, for Vygotsky, activities with perceptible pedagogical functions. If the student finds himself in an environment that gives him joy or its equivalent through games and other similar activities - which include apps - used within certain cultural contexts known and created by himself, this ends up giving rise to a zone of development close to the student. This helps them to behave more assertively in real-life activities, being able to distinguish object and meaning.

For Vygotsky, the activity of playing games and the like, by creating this zone of proximal development, increases the development of the student's capacities, who ends up building new ways of acting and behaving, escaping from the models they would normally have in each age group. For the student, the game or any other activity that has a sense of joy and generates contentment, ends up being a mediation link between the student and learning and, by presenting rules, even if they are simple, they enrich their imagination and enhance the emergence of new skills.

As a result, the students acquire new experiences, learn, exchange information, absorb the meanings of reality, create new symbols, use new representations that emerge as they carry out the fun activities, managing to converge with previous knowledge. The application has a pleasant character, as it is thought-provoking for the age group of students15 a 16 years old, who easily master technology and, in this case, through it, within a pedagogical intention, can reach new conclusions about the content dealt with.

It can therefore be deduced that the activity with the app is a form of symbolic self-expression on the part of the student, who designs their own symbols in order to represent what interests them.

The Russian Daniel Elkonin, following on from Vygotsky's work, constructed a new theory of play, differentiating between play and ludic activity, with which we also agree. In his view, play is considered to be a more developed expression of the latter.

It is understood that the LandscapAr application is not a game in the strict sense of the word, nor is it a playful activity in itself when combined with educational activity. However, because it fascinates students, it encourages interaction and cooperation, leading to a process of decentralization of creation through operative thinking and, as Elkonin explains when talking about games, it helps to overcome egocentrism, since the activity presented is done in a group. The app, which is a simulation - in this argument - makes the connection between some of the characteristics present in a playful activity (joy, motivation, affectivity) and the game (will, planning, insight).

The application was downloaded for free and installed on the device of each student who had a cell phone. The activity was carried out with ten (10) first-year high school classes at CEFET-MG, in Belo Horizonte, Minas Gerais, in the subject of Geography. Its use in conjunction with the preparation of our own teaching material allowed us to incorporate the content on terrestrial relief and, in particular, contour lines.

MATERIALS AND METHODS

THE MATERIALS

To carry out the activity, you will need some pre-prepared materials:

a) introductory exercise for the activity containing a simple relief sketch on contour lines and other models;

b) A dark, matt surface, A3 size or larger, which can be black cardboard, any black fabric, even a plain black knitted shirt;

c) a mobile phone/tablet with Android operating system version 2.3.2 or higher , containing a camera;

d) the LandscapAR app installed on your phone/tablet;

e) a black marker pen with a thick point (1.5 mm or more);

f) white A4 sheets for drawing relief sketches on contour lines.

LANDSCAPAR METHODOLOGY

Before carrying out the activity, the teacher should have already worked through the basic concepts relating to contour lines: planimetry, altimetry, equidistance, relief profile and other related concepts. Working with the LandscapAR application is used to conclude the content and for the student, with the support of the auxiliary material, to make interrelationships, deepen and consolidate their knowledge.

By default, when the application is launched, it starts the detection work in "Auto" mode. If the sketch sheet is detected, a red frame will appear around the sheet and will change to blue when it is perfectly framed. The model does not need to be framed in a perfect orthogonal view to be detected. Detection can become unstable if the view is too oblique. If this happens, simply reposition the phone's camera towards an orthogonal view. Once the image is stable and framed, it's time to press the "Scan" button (Figures 1 and 2).

The "Auto", "A4", "Letter" and "Sqr" keys are used to set the paper model to be detected by the application.

After pressing the "Scan" key, the drawing is photographed, the image is scanned and a three-dimensional model of the relief is generated. You can see that the screen changes to other properties (Figure 3).

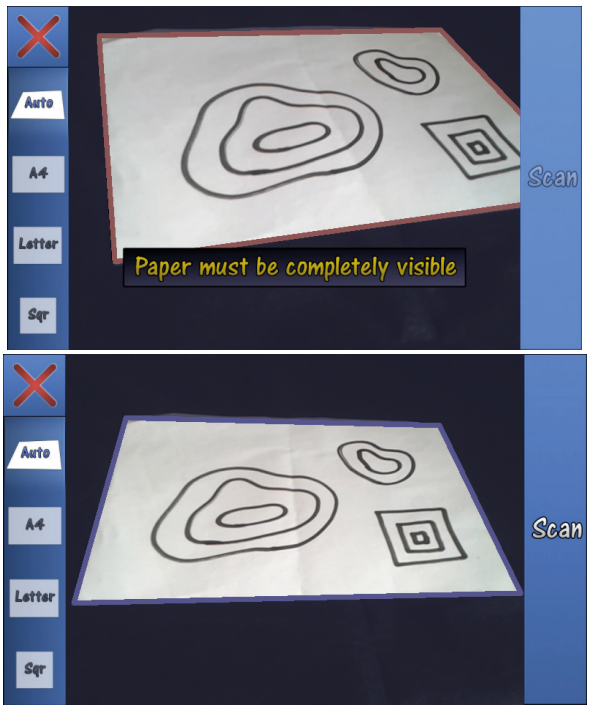


Figure 1 and 2 - The application during the sketch recognition process. Detail of the sheet detected and not framed (1) and with perfect framing (2). When the image is framed, the "Scan" key is enabled and changes color.

Source: Private collection of the authors.

Once the relief has been generated, the "photo" button can be pressed to capture the image, and another screen opens, making it possible to record the image, share it (by e-mail, *Whatsapp*, *Bluetooth*, among other ways) or publish it on the app's *Facebook page*. After recording, sharing or publishing, the app returns to the home screen (Figure 4).

If the "back" key is pressed repeatedly, the application returns to its initial condition ready for the simulation of a new relief.

Care must be taken to ensure good lighting, so that the sheet is detected correctly and the representation is read correctly. Too little or too much light can lead to errors in reading the sketch and a result that does not correspond to the representation of the contour .

THE ACTIVITY

Before the lesson in which the app would be used, the students downloaded and installed the LandscapAR app from a website such as the *Google Play Store* or a trusted repository. Normally the app is installed automatically, but in some cases there is a need for manual installation .

These were the procedures adopted to carry out the activity with the application:

1 - The class was organized into groups of up to four, at least one of which had to have installed the LandscapAR app on their cell phone. A lesson was provided for the groups to get together and test the application in class. Complementary material was prepared to be done in conjunction with the LandscapAR activity, as shown below. In this exercise, students had to correlate photographs of landforms with their corresponding contour lines. One of the contour lines was separated and enlarged for use with the application (Figures 5, 6 and 7.

2 - Take the students back to the concept of a contour line and show them a simple representation, such as a hill. A pre-tested model extracted from the exercise was made available so that the students, gathered in small groups, could test the application at first (Figures 8 and 9.

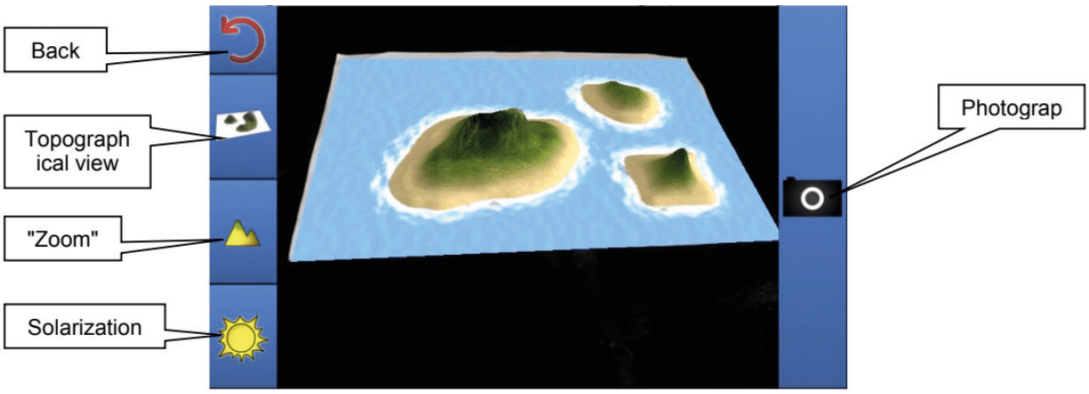


Figure 3 - Functions added after image processing.

Photo: Private collection of the authors.

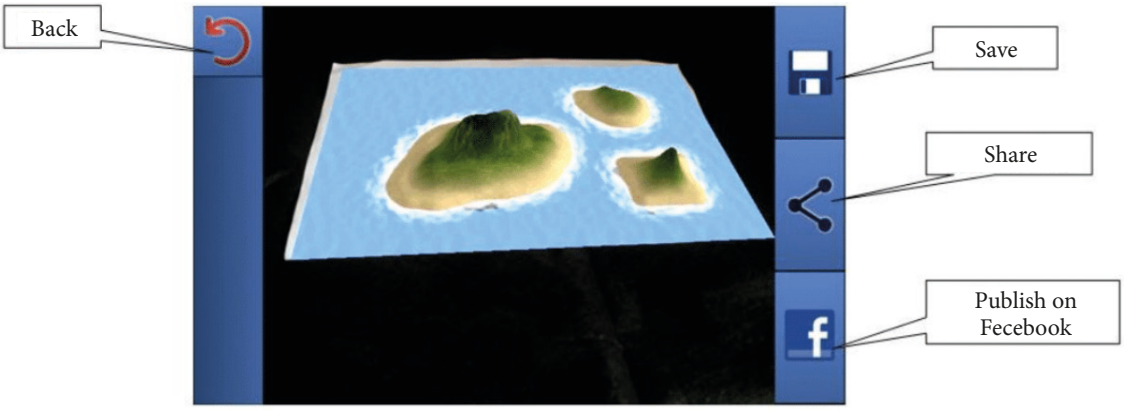
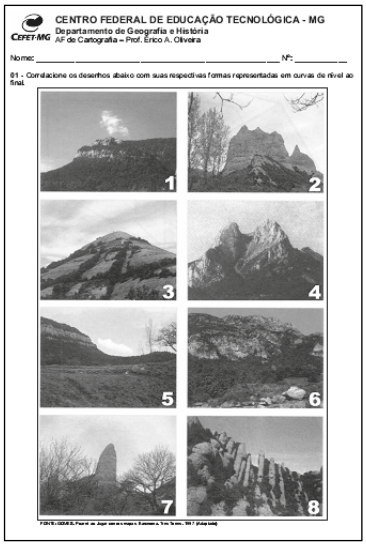
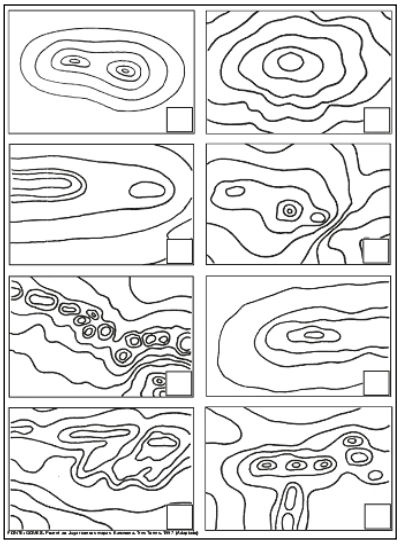


Figure 4 - Tools for recording, sharing or publish the result

Photo: Private collection of the authors.



5)



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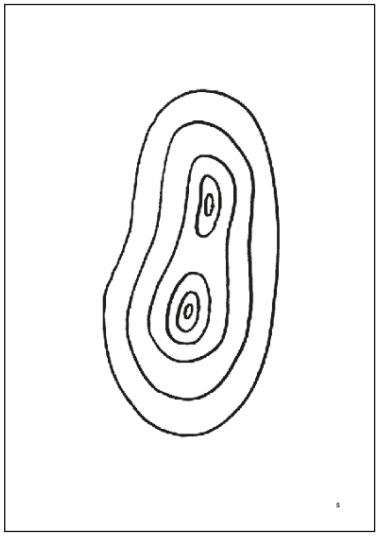


7)

Figure 5, 6 and 7 - Preparatory exercises before using the app. Photos of shapes and relief (5), representation of relief on contour lines (6), enlargement of one of the contour line representations (7).

SOURCE: Gomes, 1997 (Adapted)

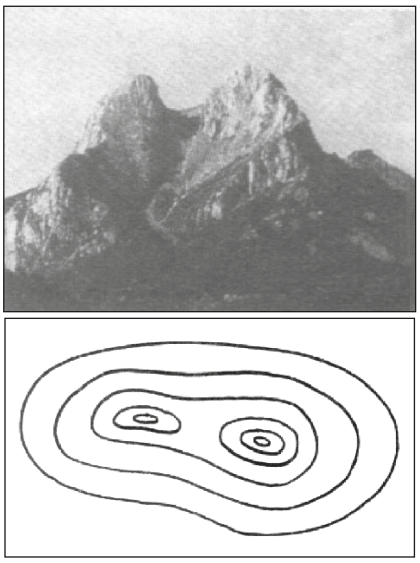
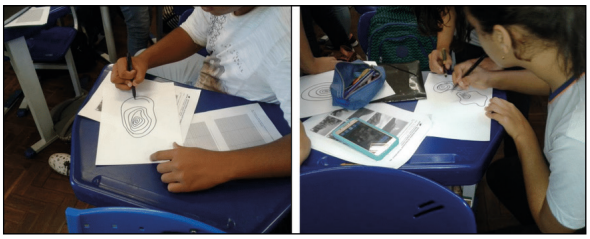


Figure 8 - View of a hill with 2 peaks. Figure 9 - Hill represented in contour lines.
SOURCE**:** Gomes, 1997 (Adapted)

3 - Draw a contour representation of a relief shape (Figures 10 and 11) on a sheet of A4 white paper, provided by the teacher, so that it occupies a centralized frame approximately 1cm or2 cm from the edge of the sheet. Use a thick-tipped (between 1.5mm and 2mm thick) black marker pen. If the contour lines are incomplete, they must be closed or completed, otherwise an error will occur when the application runs.



Figs. 10 and 11 - Students drawing their own relief models on contour lines.

Source: Private collection of the authors.

4 - Place the A4 sheet of the sketch on a dark, dull surface. We suggest using matte black cardboard or a black cloth twice the size of the A4 sheet. You could also use a black adult sweatshirt stretched out on a table or desk. Activate the LandscapAR app on your cell phone and point your camera at the sketch sheet. When the app detects the sheet with the sketch and the image is stable on the display screen, simply press the "Scan" button. The app will generate the three-dimensional model after a quick processing (Figure 12).

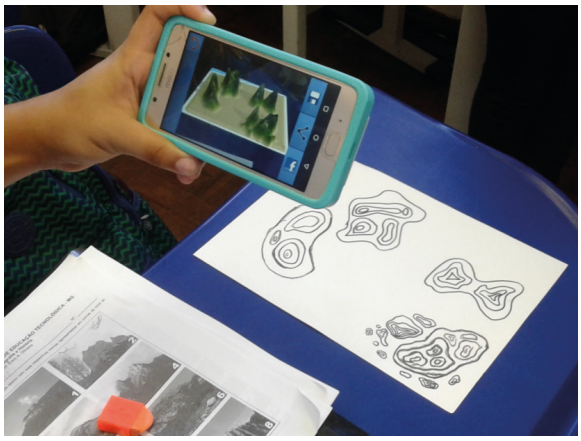


Figure 12 - Three-dimensional model being produced by the students.

Source: Private collection of the authors.

05 - As well as carrying out the performance with the LandscapAr application, the students should associate the other relief models with their respective contour lines in the given exercise. They should also relate what they have produced to the relief profile of the same, and the different views they should photograph in each profile built: oblique, frontal and lateral views. The teacher will receive the results, at their discretion, either digitally or in print on an agreed date. Once the action is over, there is a collective discussion about the results observed, the difficulties and the relevant conclusions.

RESULTS OBTAINED

The use of the LandscapAr app was very well accepted by the students, teachers and even the families of some of the students, who found it interesting. It was pleasant to work with this app and with these classes, everything went as expected, because all the groups had at least one cell phone, and once installed they didn't need to access the internet, they used the screen of their cell phone, smartphone or tablet

The students got involved in the activity, worked in groups, helped each other, created new forms of relief - graphically speaking - collectively and were able to apply LandscapAR without difficulty.

During the trials, some of the application's limitations were detected, such as:

a) all curves are assumed to have positive values, so it is not possible to simulate depressions or a model containing both types of relief;

b) it is not possible to change the vertical exaggeration proposed by the app;

c) presents only one "wallpaper" model for rendering the surface, which is repeated over the relief if it is too bulky or elongated;

d) the side view has a limitation when trying to get close to the base level of the representation. The rendered image becomes unstable and flashes on the mobile/tablet screen;

e) if the A4 sheet where the sketch is located is moved and replaced by another, the application continues with the rendered image, regardless of what is or isn't drawn on the sheet;

f) if the sketch sheet has any ripples, the application may display a reading error. The same applies if the A4 sheet has any folds in its corners or staples;

g) does not have a version for iOS (the operating system for Apple devices).

On the other hand, there are some advantages:

a) ease of use;

b) small size, not overloading the phone/tablet's memory or storage space;

c) allows you to save your work and share it via various applications (Facebook, Whatsapp, SMS, e-mail, Bluetooth...);

d) can be enhanced with the "zoom" and "sun incidence" tools;

e) does not require a perfect orthogonal view, allowing for some obliquity;

f) fast processing;

g) detects formats larger than A4 in "Auto" mode, such as A3 or A2, which can be an advantage when drawing more elaborate sketches.

h) allows the student to circle around the model as if they were flying over it.

The main point here is not the use of technology for its own sake, but the design of a new learning environment based on technology and focusing on the student's interest and skills in relation to these tools.

According to Moraes,

> Thus, the quest to improve educational quality will mean improving the learning process, which, in addition to taking into account the needs of users at each stage of their journey, also seeks new learning strategies that are more suited to the production of knowledge, which is increasingly up-to-date and expanded, leading to the expansion of human cognition and the growing intellectualization of work. (Moraes, 1997, p.7)

However, it is not enough for the educator to want to change educational practice, or to promote student interest in certain content. The student needs to think about the content, communicate with the available tool, use it as

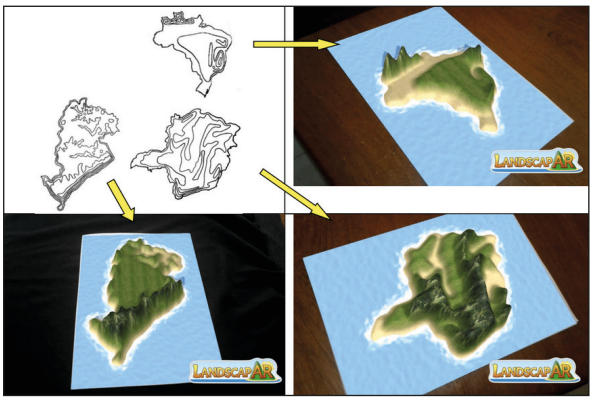
a "support", make choices and draw their own deductions from the activity carried out. Before practicing, students have already interpreted the information they have previously acquired and reflected on it, so that they can only then begin their work.

According to Ausubel's Theory of Significant Learning (1980), which specifically considers the processes of teaching and learning scientific ideas based on concepts previously formulated by students in their daily lives, learning is unique. It has an intimate and particular chain which places the student in the dynamic construction of their knowledge and which evolves procedurally according to the interests, disposition and aptitudes of each individual.

Reflecting on Ausubel's Significant Learning, Moreira describes learning as:

> [...] the new information is linked to relevant pre-existing aspects of the cognitive structure (what the learner already knows), and both the new information and these aspects are modified in the process. This is an interaction, not an association. One of the conditions, therefore, for meaningful learning to occur is the availability in the cognitive structure of relevant concepts or propositions (anchor ideas, subsumers) that make this interaction possible. The other two are that the new information should be potentially significant, i.e. relateable to the cognitive structure, and that there should be a predisposition to learn on the part of the learner (Moreira *apud* Ausubel, 1982, p. 95).

To explore the possibilities, the application was tested on the relief of the country, the state of Minas Gerais and the municipality of Belo Horizonte. However, due to the extent of the space to be represented and the rules for detecting contour lines (line thickness, overlap and discontinuity), the number of contour lines had to be reduced in order to reduce reading errors. Contour lines covering small areas also had to be disregarded. The result can be seen below. (Figures 13, 14, 15 and 16)



Figures. 13, 14, 15 and 16 - Experiments with other contour lines. Generation of relief of the country, the state of Minas Gerais and the municipality of Belo Horizonte.

Source: Private collection of the authors.

As the relief has continuity, it extends beyond borders, and in the case of a portion of space, an adaptation must be made for the application to work correctly. In this case, care must be taken to ensure that the relief to be represented is interpreted as an island. Contour lines that go beyond the limits of the representation space (the boundaries) must be interrupted and closed so that the application interprets the sketch as an island and simulates the relief.

FINAL CONSIDERATIONS

Geography teachers need to be able to handle the technologies available for teaching, whether digital or not. These are didactic resources that must be incorporated into our school practice, based on the objectives that will be set by the teachers, taking into account the reality of the students.

The inclusion of new technologies in the classroom shows promise for methodological renewal, to help with didactic-pedagogical development in the classroom. The renewal is not in the new tools, but in the differentiated vision of the teacher who tries to capture and interact with their students and thus improve the quality of the teaching-learning process.

There was great enthusiasm among the students and even some of the school's teachers, because it was a pedagogical correlation between the content taught, the material provided as support, the use of the application itself and the experience carried out in the classroom, as well as the conclusions drawn from it. It takes a prior desire to learn, a will to discover, which begins with the awakening of curiosity. When previous knowledge and the new are brought together, significant learning takes place.

Graciela Barraqué Nicolau elucidates on teaching and learning when she talks about creativity in Geography:

> [...] Contemporary man has to fully develop all the students' individual potential, to promote the development of their creativity and cognitive independence. The "set" (predispositions or aptitudes) that each individual brings is enriched by the surrounding social environment, and the school must obey what José Martí proposed, in the sense that "to educate is to deposit in each man the human work that has happened to him; it is to make of each man a summary of the living world, until the day he lives; to place him at the level of his time, with which he could fluctuate; it is to prepare man for life". This is achieved if the methods and means of problem teaching, didactic games, group techniques and study sheets are combined (Nicolau, 1991, p. 36).

There was also a lack of innovation in terms of didactic and pedagogical resources in the classroom, for various reasons. In addition, the teacher's didactic-pedagogical action must have a concept, a logic that can be understood by both the teacher and the student. It requires study and planning, a clear relationship with the content to be studied, a methodology to be created and followed, a link between the interests of the students and the teacher, and the subject covered; the verification of its effectiveness after practice. These procedures are necessary, they must be outlines, but they must not imprison the teacher, the student and the practice; they must not be seen as a book with ready-made recipes.

Of course, not all lessons will be as enjoyable as you would like, nor will the planning be based solely on what pleases the students. However, if out of every five lessons taught, at least one departs from the ordinary and takes into account the above, there will be progress. This is a "Geography of the possible."

These tools, such as the LandscapAR application, which are pedagogically structured for both the teacher and the student, easy to access and free of charge, become mechanisms for transformation, enabling qualitative improvement in the teaching-learning process. With the use of the LandscapAR application, geography lessons have become more creative and proactive, combining the teacher's pedagogical objectives with the students' willingness to use new technologies, naturally leading to meaningful learning.

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