Itinerant MakerSpaces in Central Amazon
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Introduction

The State of Amazonas is a Brazilian State located in the central Amazon. It has about 4.2 million inhabitants, 54% of which are in its capital, Manaus. Even having an Industrial Park of intense productivity formed by more than 600 industries, mostly with assembly of electronic devices, Manaus is a city that has most of its population under intense social vulnerability, which leads to lack of access to innovative technologies and quality education. This fact can pose serious risks to the development of children and young people, who are often not being provided with adequate education to prepare them for the challenges of the new economic matrices to come.

To establish themselves in contemporary society in an autonomous and critical way, students need to perceive the presence of science in the school space and understand its functioning in the context in which it is inserted. In this way, they experience a process of scientific literacy that will decisively influence the understanding of their world, allowing them to be able to intervene in it. However, the way in which science is presented to students is of great relevance, as its language often makes it difficult to understand curricular contents and scientific theories. It is in this perspective that the Academy STEM Project is inserted, based on complementary training for students from peripheral areas of the city, in mobile laboratories that are composed of a maker environment.

Academy STEM project

The Academy STEM Project is developed by the Amazonas State University and is funded by Samsung, using resources from the Informatics Law for the Western Amazon (Brazil´s Federal Law No. 39 of Decree No. 10.521/2020. The project is aimed at training and professional training that aims to enhance knowledge and instigate the interest of high school students in undergraduate courses with a STEM nature, such as Engineering, in addition to reducing dropout and failure rates at UEA. The project is divided into 03 Pillars: The Permanence pillar, which aims to reduce the retention and dropout rates of the university's engineering students; The pillar of excellence, which aims to reduce the gap between the education of engineering students and the interests and specificities of the job market, and the pillar of attraction, which seeks to arouse the interest of high school students in the STEM areas of UEA through mobile laboratories that have courses based on maker methodology.

The Mobile Laboratories of the Academy Stem Project are container-like modules transformed into Maker spaces and equipped with smartvs, notebooks, smartphones, 3D printer, laser-cut printer, among other electronic components and tools, and which have a maximum capacity of 40 students simultaneously. Since the laboratories can travel, they run through schools in peripheral areas of the city of Manaus (where students have little or no access to these technologies).

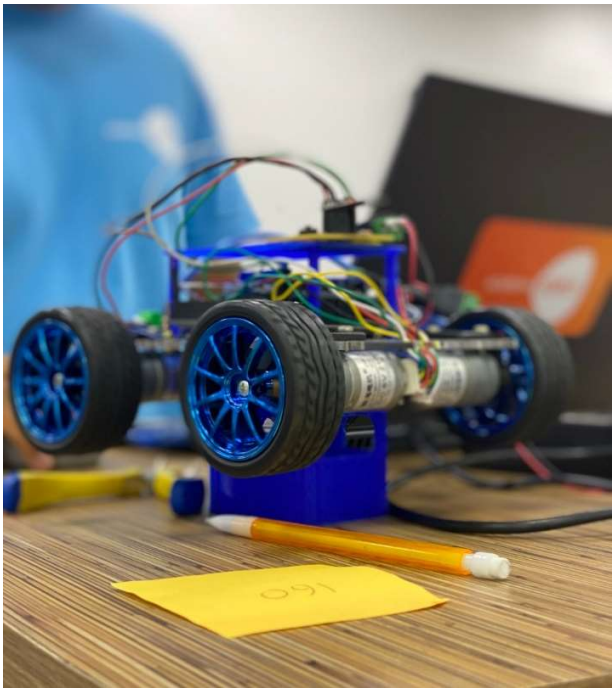

Figure 1 Image from the prototype (following line car) build at the itinerant makerspace of Academy STEM Project

It is in these laboratories that the Training Courses in Digital Technologies and Industry 4.0 are offered, with a workload of 20 hours and duration of 05 days.

During the courses, participants learn concepts of microelectronics, robotics, programming, and industry 4.0, when they build, together with the monitors (undergraduate engineering students at the University) prototypes that simulate a semi-autonomous assembly line. These prototypes are authorial and designed in our maker space by undergraduate students who became monitors during training

for high school students.

The training courses are offered at an alternative time to the normal school hours. Due to the covid-19 pandemic, the first 02 years of the project were used for the construction of the methodology and acquisition of the labs, with the training started in March 2022, training about 300 students. The perspective is that 7200 young people will be trained in the next 3 years.

Maker movement on mobile labs

The Maker culture has the potential to promote an exciting and collaborative environment in non-formal education spaces, providing practical situations in which students are the protagonists in the construction of their own knowledge and the teacher is the mediator of this process, whether technological or manual. These spaces, whether in a school environment or not, awaken skills such as creativity, proactivity, teamwork and manual skills in students and/or users, which are fundamental for the formation of citizens with a holistic and complete view of the universe around them. A possible interesting strategy is the construction of mobile laboratories, especially in isolated places where access to new technologies is precarious and scarce. These structures, taken to regions of the central Amazon such as the Academy STEM project, have the capacity to change the lives of thousands of young people and adolescents who, after having their first contact with the maker world, can expand their knowledge and enter STEM areas. in their higher education.

Figure 2 External image of the mobile laboratory. When fully open, it has almost 100 square meters and capacity for 40 students maximum

When students can build tangible materials (in addition to computer simulations), there is enthusiasm, wonder and interest in the content covered. In general, they highlight that manual work transforms what used to be just theoretical ideas into concrete material elements, bringing what was previously learned only in theory into practice. This construction, which goes through several stages to carry out the project such as planning, choice of materials, and construction, make students learn, in addition to robotics and programming, teamwork, scientific method and even mathematics, physics, chemistry and engineering in a simple and fun way.

It is in this way that we seek to foster a process of scientific literacy for students who participate in Training Courses from teaching strategies based on Active Methodologies with activities connected, planned and organized by the theoretical-methodological premises that support the STEAM approach. The Active Teaching Methodologies emphasized the Marker Culture, which seeks to work with students in a space equipped with innovative technological resources linked to major scientific advances. Furthermore, it is worth mentioning that these activities were developed in a place called by [1], non-formal, considering that tasks were objectively conceived in a different environment from the traditional one that will provide the learning of formal schooling. This is a highly relevant fact, as it arouses the curiosity and interaction of students who leave formal school spaces to explore other spaces.

In this perspective, there are studies that strengthen the use of active methodologies such as the Marker Culture and STEAM, given their promising results, as [2] point out, with the survey of several studies that used the Marker Culture in Brazil and Germany, in addition to the retraction of the good experience in the use of this methodology, due to the result of the development, with regard to the scientific literacy of the students. Thus, it is also addressed by [3], about the STEAM methodology in which the promotion of both scientific and technological, digital literacy and active learning of students is mentioned.

Conclusions

Young people in the contemporary context grow up at the beginning of the century characterized by great techno-scientific advances that are transformed at a speed never seen in human history. We believe that the development of teaching activities based on active methodologies in non-formal spaces, such as itinerant makerspaces of the Academy STEM Project, allow participating students to experience a scientific literacy process that will contribute to increasing their chances of reaching university, and to awaken critical and autonomous thinking, making them more aware citizens and with manual and technological skills that stimulate creativity, making them capable of associating different fields of knowledge to develop products for social well-being.

References

[1] M. G. GOHM, *"Non-formal education and political culture: Impacts on third section associations"*. São Paulo: Cortez, 1999.

[2] A. B. G. CARVALHO, D. B. POCRIFKA, "Maker culture and the use of digital technologies in education: building bridges. *Rev. Tecnologias na Educação*, v. 26, n. 26, Minas Gerais, 2018.

[3] M. G. CLEOPHAS, A. CHECHI; "Alternate Reality Game (ARG) and STEAM: a viable articulation in promoting multidisciplinary learning", *Rev. Tecnologias na Educação*, v. 28, n. 28, Minas Gerais, 2018.