Callidus Academy Project Bringing a New Vision on Professional Training Related to the Industrial Pole of Manaus (PIM)

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Abstract
The Callidus Academy is a project of the LUDUS ecosystem, from the State University of Amazonas, in partnership with the company CALLIDUS INDUSTRIA COMERCIO E SERVIÇOS DE PLACAS E COMPONENTES ELETRONICOS. To solve the problems of the PCB industry, the project carries out case studies with the research of causes and effects involved in the assembly and welding processes, training professionals in the areas of manufacturing and testing, involving topics such as SMT, Lean Manufacturing tools, Industry 4.0, welding metallurgy and testing of manufactured boards. The information technology area faces a shortage of professionals in Brazil, with an expected demand of 420,000 IT professionals by 2024. Skilled labor affects the Industrial Pole of Manaus (PIM), causing competition between companies for these professionals. To increase efficiency and productivity in the industry, reducing errors and redundancies in production, the Lean Manufacturing management system has been widely disseminated, with the application of concepts aimed at reducing waste and optimizing resources. These concepts are in line with the premises of the modern theory of Industry 4.0. Thus, to solve this problem, we started to train the professionals of the company Callidus, with the methods: “Learning by doing” and “Learning by interacting”. These methods are more effective when it comes to adults, as it makes training classes more interesting, less tiring, and easier for learning, making the student remain in training until the end. With this strategy, in the first year of the project alone, 135 students were trained.

Keywords: Learning by Interacting, PCB Industry, Industry 4.0

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Introduction

There is an estimate by the Brazilian Association of Information Technology and Communication Companies (Brasscom, 2021) that by the year 2024, Brazil will need 420 thousand information technology (IT) professionals. Brasscom also alerts that the country currently graduates approximately 46 thousand professionals per year. In this context, the Manaus Industrial Pole (PIM) experiences a shortage of IT professionals, resulting from a lack of skilled professionals and intense competition for talent from various technology companies in the region, as well as tech firms across Brazil.

In general terms, there is a deficiency and scarcity of qualified workforce across various sectors, where the demand for professionals surpasses the number of available positions. This scenario forces companies in need of these professionals to look externally, beyond the state's boundaries, since the job market is highly competitive and the absence of these professionals leads to revenue losses and delays in strategic projects, causing companies to miss out on investments. The solution lies in providing training to students in the region, focusing on technologies geared towards industry applications.

Another scenario that companies face is that the training of these professionals is not immediate; it takes time. In some cases, the academic content taught is not aligned with the interests of the job market, mainly because many courses are heavily theoretical and lack practical experiences provided in the classroom. This delay hinders the integration of these future graduates from undergraduate, high school, and post-high school courses into the job market.

The project aims to precisely address this gap between the immediate needs of the industry and the theoretical-practical content required during students' education. It covers advanced aspects of technological subjects typically seen in postgraduate courses, such as Artificial Intelligence, Computer Vision, Metallurgical Technology, Lean Manufacturing, PCB Production, and Industry 4.0. This approach will undoubtedly bring the graduates of this project closer to the real needs of the industries in the Manaus Industrial Pole (PIM) regarding qualified professionals.

Methodology and Development

Taking into consideration this problem, Callidus Indústria de Componentes Eletrônicos proposes this project that will initially train students from the 2nd and 3rd periods of the State University of Amazonas, from the School of Technology, which are part of the courses of Information Systems, Computer Engineering and Computer Science, aiming to enable students with technologies that are used in companies installed in the Industrial Pole of Manaus.

The project will also train people from the industry linked to the manufacture of printed circuit boards in the areas of manufacturing and testing, involving topics such as SMT - Surface Mounted Technology, Soldering Metallurgy and Testing of manufactured boards. This approach will consider the problems that may exist in the area of quality related to the main products seeking to identify deficiencies in materials, labor, machinery, methodologies used and measurement and evaluation systems employed in their approval or disapproval. And it is on this second topic, which is the training of people in the industry, that this article will address an analysis of how the active methodologies employed in the project, can be

validated by the evaluation of the students graduating from the courses. The courses are training in metallurgy and welding technologies of electronic components, SMT assembly technologies, Products and Testing Methodologies and, mainly, Lean Manufacturing Applied to Industry 4.0, in which the article will address a case study for the class, to analyze how the learning of this course will influence their day-to-day work and how the methodology addressed was of impact on their learning.

Lean Manufacturing is a management system designed to increase efficiency and productivity by reducing errors and redundancies in industrial production. With the arrival of industry 4.0, the importance of companies maintaining their competitiveness has been enhanced. This is one of the basic courses taught to student-professionals, so that they have control and assertiveness within the industry.

The Management in Industry 4.0 course is designed to train participants in People Management, making them aware of the company's leadership styles and their suitability for industry 4. 0 through the following actions: a) Reinforce the commitment to their continuous self-development process; b) Train participants in skills aimed at a better interpersonal relationship in teamwork; c) Sensitize and instrumentalize participants to guide the development of other professionals in their team; d) Stimulate the exchange of experiences between professionals from different areas and business units; e) Strengthen bonds between participants; f) Encourage participants to reflect on the impacts and potential of their actions inside and outside the company context; g) Invest in active training aimed at problem solving and continuous improvement. The training will consist of 40 theoretical hours and 40 hours of hands-on, practical activities and active monitoring, with a total of 80 hours.

In the hands-on division, the methodology used in the lean manufacturing course are: "leaning bv doing" and "learning by interacting," with the use of LEGOS assembly, where different boxes were made available to each group and only with the image of the object that should be assembled, where the team would apply the methods studied in the theoretical course to assemble in a timely manner and with all the quality (the assembly being more faithful to the image). After the whole process, the manuals were made available to check what they approached differently but that made them arrive at the same assembly result.

Why use these active methodologies to teach adult professionals?

- The "Learning by Doing" methodology is preferred for teaching adults.
- Adults learn best when they are actively involved in the learning process.
- The Learning by Doing approach enables active engagement of adults.
- Adults value learning that is relevant and applicable to their lives and careers.
- The methodology allows for practical application of knowledge.
- Adults prefer to take responsibility for their own learning.
- Learning by Doing promotes autonomous learning.
- Adults retain information better when they are involved in practical activities.
- The methodology helps to build a solid knowledge base.
- Adults also learn through interaction with their peers.
- The methodology promotes collaboration and the exchange of ideas.

Note: Rubeus (2021), Pelica, R. O (2017).

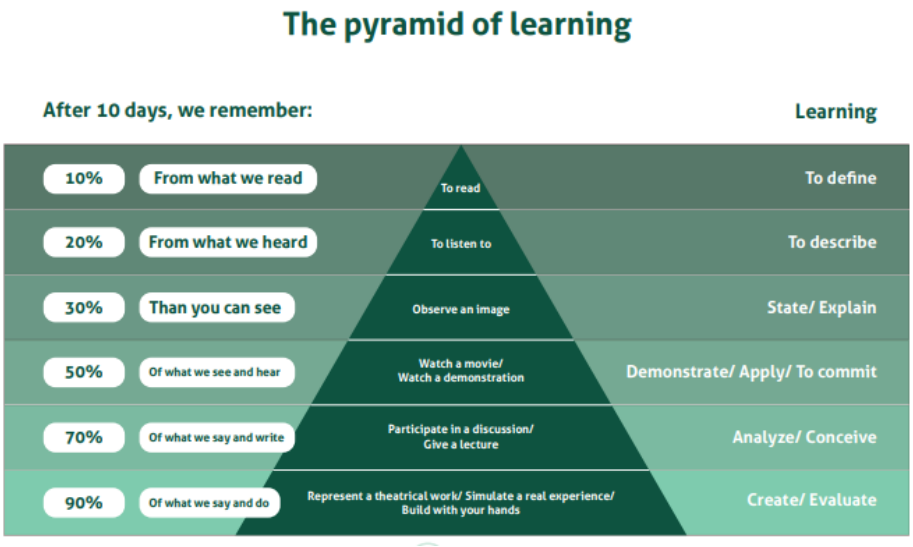

Figure 1 - Example of fixation of each type of study methodology

Conclusion

In the first year of the project (July/2022-March/2023) 135 students were trained, in all four courses had active methodologies employed, so that students could have the interaction of what was taught in the Lean Manufacturing course applied to industry 4.0. Where they applied the methods to be efficient within the industry while learning about metallurgy and welding technology, SMT assembly technologies and test study technologies. An evaluation form of the courses and their methodologies was applied and, in the graphs, below we report the students' achievement, each one reported on their positive experience and gave their opinion of what needs to be improved.

In the questionnaire addressed, the responses of 90% of the students showed that the methodologies applied were enlightening and innovative, stimulating. Regarding the subjects addressed 85.71% reported having been enlightening and objective. And 100% reported having been applicable daily.

About what could have been improved, the students mentioned about not having more course time, as they would have been of great benefit, and two mentions were reported of improvements but related to the distance from the workplace to the university, where the courses are applied.

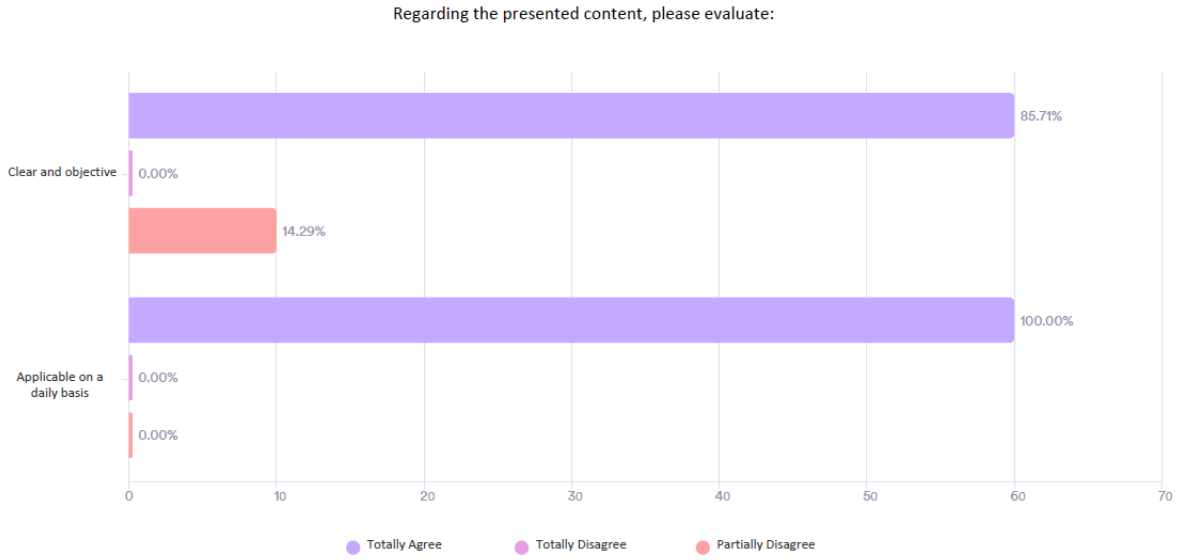

Figure 2 - Evaluation chart about the Lean Manufacturing course to the students

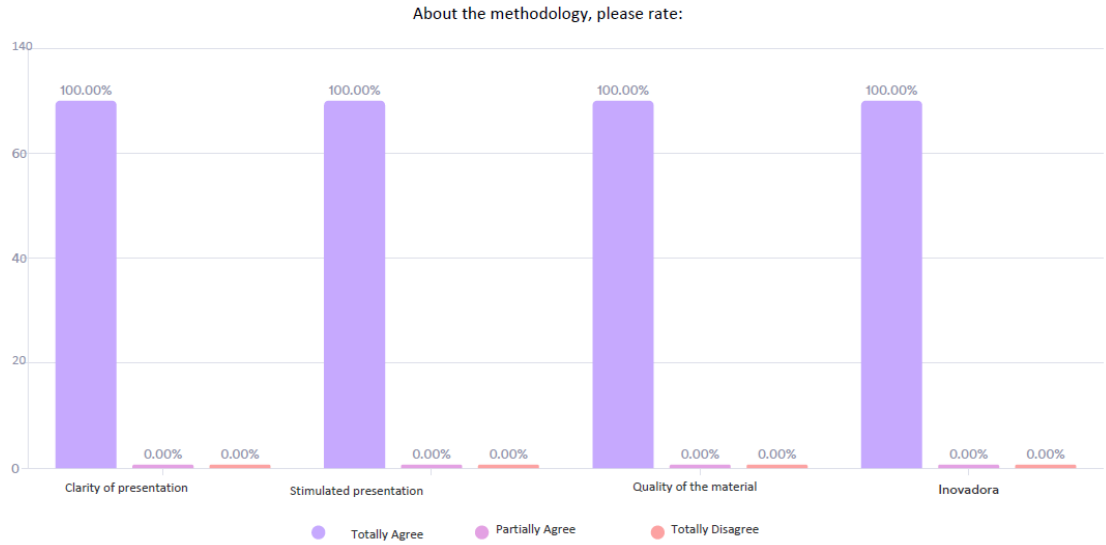

Figure 3 - Evaluation chart on the methodology used in the Lean Manufacturing course

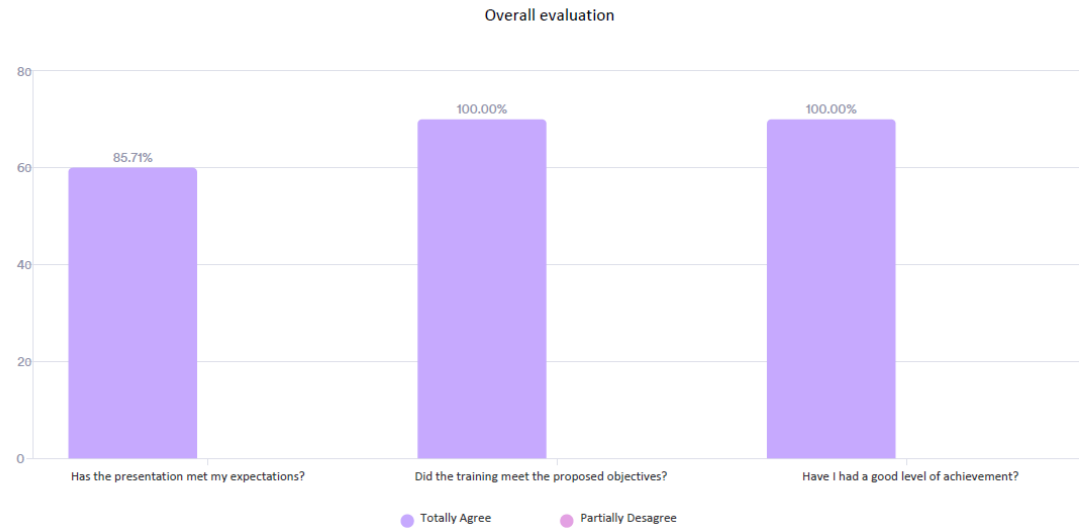

Figure 4 - Overall evaluation chart on the utilization of the courses in general applied by the project

These two previous points are one of the limitations to attract more students from the factory to the project courses, because the courses are applied in the night shift and with that the majority already leave very tired, one of the points to be discussed so that we can improve and disseminate the course, is to disseminate the results to other employees, and show that the active methodologies applied can improve learning.

There are great expectations that this will increase the demand for the courses and that we can present them to other companies in the same sectors within the Manaus Industrial Pole and thus increase the level of professionals trained for the demands of the industry.

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