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ACTIVE METHODOLOGIES AS INCENTIVE TO INNOVATIVE AND OPEN BEHAVIOR

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Abstract: Open innovation (AI) is a new path for managing innovation in companies and maintaining competitiveness. In this model, companies use internal ideas and, through partnerships, the innovative capacity of external sources. Among the advantages there is a reduction: in the time for innovation, costs and risks. Despite the advantages, there are barriers to adoption that can be minimized by training teams in concepts and practices. This article aims to show that the use of active methodologies creates learning situations that can encourage the adoption of AI practices and stimulate a positive view of this business model in undergraduates, expanding their skills in professional practice. A bibliographical research was carried out, related to AI practices and active methodologies and a case study with 6 management course classes of a higher education institution in the interior of the state of São Paulo. The results showed that the use of active methodologies had a positive impact on the evaluation of AI and the adoption of its practices. Among the main results are: expansion of the positive view regarding the involvement of internal teams (not just R&D), customers and suppliers in innovation processes; the need to expand knowledge regarding intellectual property; improvement of interpersonal relationships in future interactions with partners.
Keywords: Open innovation (ai); active methodologies, competencies.

INTRODUCTION

Innovation has been the great challenge for companies as it is considered a source of competitive advantage (SAUNILA, 2019), so necessary to face the socioeconomic crisis, amplified by the pandemic, which affects the survival of many Brazilian companies and can further exacerbate social inequality.

The Open Innovation (AI) paradigm offers companies a new way to manage innovation, expanding possibilities and reducing costs.

This new path, according to Chesbrough (2003), enables companies to use external ideas and knowledge to leverage their internal research, as well as allowing ideas and technologies that are not used by the company to be released to be commercialized in the market.

In addition to internal ideas, companies, in this new model, use the inventive capacity of other sources, establishing partnerships.

Van de Vrande et al. (2009) state that companies are motivated to use AI to serve their customers or open new markets and the main barriers arise in the interaction with external partners, related to management and organizational culture.

The "Not Invented Here" Syndromes (*not invented here* - NIH) and that of "not sold here" or "not shared here" (*not sold here* or *not share here* – NSH) they are also considered as barriers to the adoption of AI (CHESBROUGH, 2003; LICHTENTHALER; ERNST, 2006).

Burchart, Kudsen and Sondergaard (2014) consider that the negative impacts of NIH and NSH syndromes can be minimized through training.

Sing et al. (2018) state that the adoption of AI practices also depends on the knowledge, support and vision – whether positive or negative – that leaders have of this new model.

AI training, both on concepts and practices, for internal teams creates, according to Barham, Dabic and Shifrer (2020) a broader awareness of the subject and removes resistance barriers.

If resistance to the adoption of AI by companies can be minimized through training teams, both in concepts and in the application of its practices, how can this type of experience be promoted in undergraduate courses?

This article aims to show that the use

of active methodologies creates learning situations that can encourage the adoption of AI practices and stimulate a positive view of this business model in undergraduate students.

To fulfill this objective, a bibliographical research was carried out related to AI practices and active methodologies and a case study in a higher education institution.

This article is structured in 5 sections: the first this introduction, the second containing the theoretical framework; the third, referring to methodological aspects, presents the systematic application of active methodologies and data collection; the fourth presents and discusses the results; and the fifth deals with the final considerations.

FROM OPEN INNOVATION (AI) TO PROFESSIONAL COMPETENCIES

The most accepted definition of AI is that of Chesbrough (2003), who, in addition to coining the term, states that ideas of value can come from inside and outside the company and can go to the market through projects internal or external to the company.

This definition makes innovation a joint action of different actors and permeable to the boundaries of companies (CHESBROUGH, 2003).

To confront the form of closed innovation (FI) with AI, Chesbrough (2003) elaborated assumptions listed in Table 1.

Huizingh (2011) states that AI has become an "umbrella" that integrates, encompasses and connects several activities that, according to Gassmann and Enkel (2004), can be distributed, according to the flow of knowledge and technology, in three categories: from inside to outside the focal company; from the outside to the inside of the focal company and coupled to another organization.

As important as understanding the input and output flow of knowledge and technology in the company is understanding "how to do" AI, or better yet, identifying AI practices.

OPEN INNOVATION (AI) PRACTICES

The characterization of AI practices is shown in Chart 2, based on the work of Van de Vrande et al. (2009), according to Scaliza and Jugend (2014, p.4) "the most accepted in the scientific community and the most accessed by the Technovation journal since its publication".

These eight practices were obtained through research with data from 605 small (from 10 to 99 employees) and medium-sized companies (from 100 to 499 employees), recognized as innovative (manufacturing and services) in the Netherlands (VAN DE VRANDE, et al, 2009).

In addition to the characterization of the practices, it is necessary to know which elements would be the motivators and which would be the barriers to the adoption of AI.

MOTIVATORS AND BARRIERS TO AI ADOPTION

Rogo et al. (2014) and González-Sánchez and García-Muiña (2011) point to organizational culture as a motivating element, unlike Van de Vrande et al. (2009) and Savistskaya et al. (2010) who identify it as a barrier. Scaliza, Jugend and Alves (2017) state that there are a variety of scenarios in which AI is linked to organizational culture. According to Scaliza (2020), each type of organizational culture can influence the adoption of AI practices from the inside out or from the outside in.

In general terms, maintaining competitiveness is one of the main motivations for adopting AI practices (VAN DE VRANDE et al., 2009).

Among the main barriers can be highlighted:

Closed Innovation (IF)	Open Innovation (AI)
The best professionals in our segment work for us.	Not all good professionals work at the company. We need to work with qualified professionals from inside and outside the company.
To profit from R&D the company itself needs to discover, develop and commercialize the ideas.	External sources of technology and knowledge can add significant value to the business, which, however, does not release internal R&D from doing its part.
If we discover it ourselves, we will be the first to introduce it to the market.	We don't need to generate innovation to profit from it.
If we are the first to commercialize an innovation, we will win.	Building a better business model is more important than getting to market first.
If we create the most and the best ideas we will win.	If we make the best use of internal and external ideas, we will win.
We must control and protect our intellectual property so that our competitors cannot access or profit from it.	We must profit from other companies' use of our intellectual property and also purchase intellectual property from others whenever it means advancing our business.

CHART 1: Assumptions of closed innovation (FI) and AI

Source: Adapted from Chesbrough (2003, p. 36-37)

Flow	Practice	Definition
Inside out	Venturing	Starting a new company based on knowledge, financial resources, human capital and other support services from the focal company.
	Sale or license offer	Use of your intellectual property (patents, copyrights and trademarks) as a source of income through sales.
	Employee engagement	Leverage knowledge and initiatives of employees who are not involved in R&D to develop innovations.
From the outside in	Consumer involvement	Engagement directly with customers in product or process innovations through active market research, checking their needs or product modifications similar to yours.
	External networking	Leveraging or collaborating with an external network of partners, sharing knowledge, teams or infrastructure to support innovations.
	External Participation	Receipts from external funding sources to gain access to knowledge or other synergies
	Outsourcing of R&D/ Outsourcing	Purchase of services from other organizations such as universities, public service organizations, private organizations
	Purchase or use of external patents	Purchase or use of other organizations' intellectual property

CHART 2: AI practices by Van de Vrande et al. (2009)

Source: Adapted from Van de Vrande et al. (2009, p.428)

the internal management of AI (LEME et al., 2015; MEDEIROS et al., 2017); the identification of suitable partners (FERRARI; SCALIZA; JUGEND, 2019; PAULO et al., 2017); the relationship with partners during the process (SOUZA ANDRADE et al., 2016); cultural, ethical and knowledge differences (ROCHA; MAMÉDIO; QUANDT, 2019); the non-appreciation of intellectual protection practices in companies located in developing countries, such as Brazil (THOMAS, 2018).

Whether motivators or barriers, each one is a factor that in organizations translates as a business activity and impacts the capacity for innovation (DOBNI, 2008).

According to Valadares, Vasconcellos and Di Sério (2014), for each determining factor of innovation capacity, there are specific management practices performed by the organization's professionals.

Each of these management practices, to be carried out, requires knowledge and experience that develop skills and competences.

According to Chiavenato (2015), ability is the ability to transform knowledge into action, the know-how.

Competence is the integration and coordination of a set of knowledge, skills and attitudes (C.H.A.) that in its manifestation generates a differentiated professional performance (CHIAVENATO, 2015).

The skills and competences necessary for the development of professions in Brazil are available in the Resolution of the National Council of Education, Resolution CNE, which establishes the curricular guidelines of courses for Higher Education Institutions. In the Pedagogical Project of the Course, the formative itinerary is mapped and the abilities and competences are related to the curricular components.

This mapping of the formative itinerary is what started the search for active methodologies that could contribute to the development of the necessary skills and competences to broaden a positive view of AI and, if possible, reduce the difficulties and barriers related to its adoption.

ACTIVE METHODOLOGIES

Active methodologies according to Maciel et al. (2020) are practices used in the teaching-learning process that cause a change in roles, the student assumes the leading role and the teacher is the catalyst and will be seen as an advisor, a mentor.

The use of these methodologies can favor the student's autonomy and are alternatives to enrich teaching, enabling the development of skills and competences in students, essential to keep up with the challenges of professional life. (BERBEL, 2011; FILATRO; CAVALVANTI, 2018)

According to Faraco et al. (2020), active methodologies can be applied in different ways: *Problem-Based Learning* (learning based on problem solving - PBL), Project-Oriented Learning (learning based on projects - POL), Peer Instruction (learning in pairs - PI) and Team-Based Learning (learning in teams - TBL). There is also Word Caffee (learning through conversation, constructive dialogues), Gamification (learning through games), Challenge Based Learning (challenge-based learning - CBL) and even Design Thinking (design thinking), which according to Filatro and Cavalcanti (2018) is a human-centered approach that promotes problem solving and is used when you want to stimulate creativity and facilitate innovation processes.

The use of active methodologies can occur in isolation or together, using real or simulated experiences. They are integrated into educational objectives and are used to develop the following skills: analytics; critical thinking; of research; reasoning of ideas; of argumentation; expression of opinion; time management; problem analysis; to work in

teams; to exercise analysis, observation and critical skills and to establish connection with professional practices (FILATRO; CAVALVANTI, 2018; MACIEL et al., 2020; CRUZ; MIRANDA; LEAL, 2020).

METHODOLOGY

For the preparation of this article, a bibliographical research was carried out in books, magazines, scientific articles and electronic documents that deal with the conceptualization of AI practices, active methodologies, skills and competences. Thus, the investigation was developed using the bibliographic survey to conduct and treat the case under study (YIN, 2016).

The case study investigates a phenomenon considering its context, that is, it performs an analysis under the real situation (YIN, 2016). This research modality was carried out through the combined use of active methodologies applied in 6 groups, 3 of the Technology in Business Management course and 3 of Technology in Human Resources Management, of an university located in the interior of São Paulo, making a total of 158 students.

The results were analyzed based on the raised theoretical and empirical references.

OPERATIONAL PROCEDURES

The procedures for carrying out this study and the materials produced are described as shown in Chart 3, following the chronological order of application.

RESULTS

The sample consisted of 158 students: a) 53% women and 47% men, b) 42% from 21 to 30 years old, 27% from 31 to 40 years old; 12% from 41 to 50 and 3% from 51 to 60 years; c) 61% declared themselves white and 24% black; d) 51% are from the Technology in Human Resources Management course and 49% from the Technology in Business Management course; e) 60% claimed to work with professional registration in the Work and Social Security Card (CTPS), 17% declared themselves unemployed, 9% working in their own business and 14% declared to be working, but without an employment relationship.

When starting the activity, 72% of the students stated that they wanted to choose the members to compose their teams and were dissatisfied with the random distribution; 52% said they had difficulties interacting with other members. When forming groups, students tended to get together by affinity, and there were many cases in which they remained in the same groups throughout their academic life. In these cases, students established strong bonds of friendship, but lost the chance to expand their network of contacts, practice assertive communication, manage conflicts, listen and/or accept different opinions.

Harmonious groups, according to Robbins and Judge (2014) can become insensitive to the need for change and innovation, so necessary in professional activities. The importance of renewal in the assembly of work groups, in addition to training in the management of interpersonal relationships and diversity, are important for organizational learning (SILVA et al., 2020).

Every week new situations were proposed, but the random choice of team members was maintained until the last activity and the results of the second survey showed that 57% of students no longer cared about the change and 64% reported no longer having difficulty interaction, being prepared to work with different teams.

Regarding specific situations, which addressed the need for innovation and how to manage it, the sequence of actions proposed by Bessant and Tidd (2009) was used: generation of new ideas, selection of the best ones and implementation of the new idea.

Action	Description
Survey period	Study carried out with classes from the 2nd semester of 2020 and 1st semester of 2021, in classes of practical activities present in the curriculum and schedule of every week.
Selection of active methodologies	The selected active methodologies: learning based on problems (PBL), on challenges (CBL) and on teams (TBL) were selected because they are the ones that are closest to the actions carried out by professionals in the search for solutions in organizations. (FILATRO; CAVALVANTI, 2018; MACIEL et al., 2020)
Problem situations	Surveyed together with students at the beginning of the semester through a form in *MS Teams*, from which company and student identification were omitted.
Cards	Produced in word, recorded in PDF format, each with a "problem situation" to be solved and a minimum and fictitious company profile, located in the city of the universities so that the local infrastructure would be the same for everyone.
Number of Cards	25 letters were produced with different problem situations and at each distribution, the ones already distributed were removed, so that the class did not receive a repeated letter.
Number of teams	In each class, on average, 5 teams were formed with a maximum of 5 students each. There were few times that a group formed 6 teams because the days of 100% attendance were rare.
Research environment	Performed via the internet, through the platform *Microsoft Teams,* used for *online* classes universties, due to the pandemic.
Questionnaire	Produced and applied through *Microsoft Forms* to identify actions and behaviors accepted and/or already performed by students before and after the application of Active Methodologies to assess the existence and possible evolution of AI concepts.
Division of the Teams	The teams were formed, in each class, with a maximum of 5 students, automatically with a *Microsoft Teams* resource that performs the division at random.
Formation of the Teams	Each team must choose from among its members a leader, a customer, a supplier, and two employees. NOTE: if the company profile included a Research and Development laboratory, one of the employees would work in this area.
Team members	Each member of each team must choose their role (leader, customer, supplier, employee, R&D employee) and act as such.
Query	During the activity, consulting the internet, the teacher, the author of this research or members of other teams was not prohibited.
Distribution of letters	After the teams were formed, the letters with the problem situations were inserted into the teams through the *Microsoft Teams* feature of sending a file in the chat.
In search of the solution	Upon receiving the letters with the problem situations, the groups had to dialogue in the search for feasible solutions according to the company's profile contained in the letter. Each team member must contribute, according to their role (leader, customer, supplier, employee, R&D employee), but without ceasing to be the person they are, therefore being able to make use of all the knowledge and professional experience they have.
Presentation of the solution	All teams, after the time established for that round of cards, must present the problem situation and the solution proposed by the team to the whole class.
Assessment	Each solution was evaluated by the teacher (identification of the issue, domain of knowledge, proposed solution and alternatives). The sum of the solutions was the final score.

TABLE 3: Operating Procedures carried out for the research

Source: the authors

It was clear to the students that this sequence, despite seeming simple, cannot be underestimated; generating new ideas requires technique, to select the best ones: it is necessary to test, to then implement the new idea (BESSANT; TIDD, 2009). At this stage, PBL methodologies and design thinking were widely used so that viable and innovative solutions were proposed for the challenges contained in each letter. All searches for solutions remained in the team and with the team. Even though consultation was allowed, few students actually used the internet on a scientific basis, as they believed that the solution must be the result of the knowledge they had, as if it were a memory test.

As the contents of closed and open innovation, their assumptions and practices were being taught, the students admitted the possibility of searching for solutions outside the team, that is, "beyond the company's borders", but they started this process after 3 weeks and very slowly claiming that "they understood it to be necessary, but did not see how to do it and where to start" confirming what many researchers say that expanding knowledge about AI management, that is, understanding "how to do it" is a great field of research. research (HUIZING, 2011; CHESBROUGH; VANHAVERBEKE; WEST, 2017).

The result of the questionnaire applied to the teams before and after the AI contents were taught and exercised through the application of active methodologies demonstrates that there are behaviors that were impacted and others that need further clarification, knowledge and culture change, as is the case of intellectual property, a topic that still raises many doubts and deserves to be further explored.

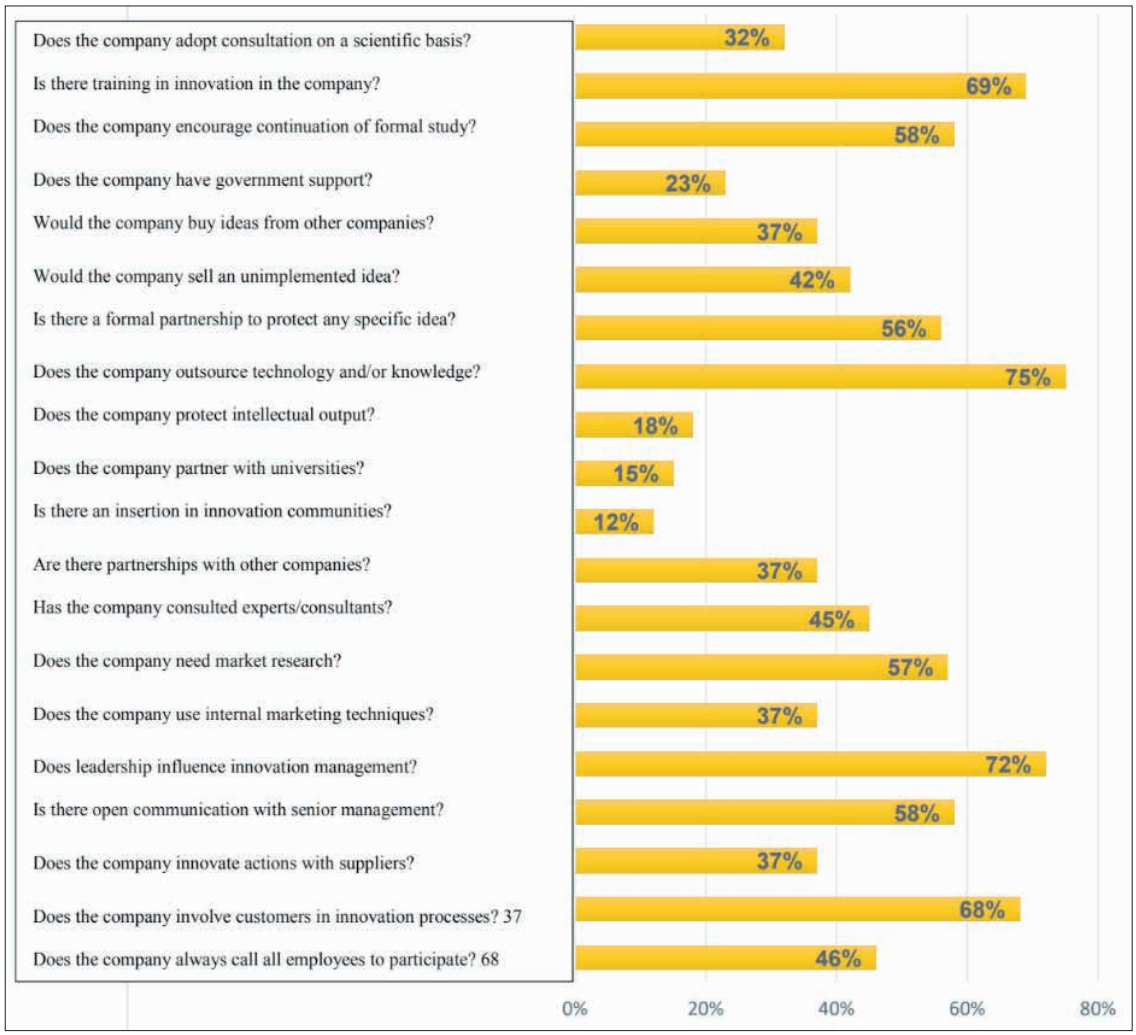
Regarding the involvement of employees, customers and suppliers in innovation processes, there was an increase in the perception of need among students, with emphasis on ordinary employees, not only those dedicated to Research and Development (R&D), but also on suppliers, thus understanding that in the innovation process everyone must be heard. To this end, improving communication channels with senior management (58%), investing in internal marketing (37%) and training on innovation in the company (69%) are actions that must be adopted, as well as encouraging employees to give continuing formal study (58%).

In the perception of 73% of the students, the commercialization of intellectual property needs specific and deeper study; 13% of the students realized that a specific R&D sector can be possible for any company, not just the big ones, 19% of them realized that all company employees can work under a culture of innovation and not just those in R&D. However, the fear of exposing an idea or spending too much, trying to innovate, was reduced in only 3% of students, as well as a reduction of only 6% of students in relation to the belief that when sharing the idea it can be "stolen". by some competitor.

These results confirm research that points to the emergence of barriers to the adoption of AI in partner identification (FERRARI; SCALIZA; JUGEND, 2019; PAULO et al., 2017), interaction with partners during the process (VAN de VRANDE, 2009; SOUZA ANDRADE et al., 2016), as well as cultural, ethical and knowledge differences (ROCHA; MAMÉDIO; QUANDT, 2019).

The other results in the perception of students who suffered a positive impact in relation to the adoption of practices that motivate or eliminate barriers to the AI model, can be seen in graph 1.

In the perception of 75% of the students, the outsourcing of technology and/or knowledge is a reality, since the use of management and control *software* licenses, as well as the use



GRAPH 1: Result of change in perception after using Active Methodologies (in %)

Source: the authors

of third-party machines and equipment, is carried out by companies with different profiles and sectors to complement the production process, expand sales and serve customers.

Partnerships with universities (15%) and insertion in innovation communities (12%) still remain at low percentages since, in the perception of 88% of students, only technology-based companies (EBT) would form such partnerships, that for traditional companies, partnerships would occur more easily with other companies (37%) and with individual consultants (45%).

FINAL CONSIDERATIONS

AI is a new business model that has the potential to maintain the competitiveness of companies in the face of increased competition and the socioeconomic crisis, especially in the current moment in which we are witnessing the collapse of countless companies in Brazil and in the world, which close work and increase socioeconomic inequalities.

Finding ways to minimize the barriers to its adoption is to give a greater number of companies the possibility of overcoming the challenges imposed by the current scenario.

Bringing this action to the classroom is a way of expanding the skills of future professionals and making use of active methodologies in this activity is a way of reinforcing the need for innovation.

The objective of showing that the use of active methodologies creates learning situations that can encourage the adoption of AI practices and stimulate a positive view of this business model in students was achieved.

Future studies can be directed to the use of active methodologies to identify the most accepted practices and verify if there is an order of adoption that would gradually expand the behavior aligned with the open innovation model.

Seeking new ways to expand students' skills and encourage innovative and open behavior, as well as showing them the possibilities of partnerships with the university that they are part of, can be one of the best ways to promote the much-needed socioeconomic development of our country.

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