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**EVENTO EN LÍNEA COMO PRODUCTO DE LA  
METODOLOGÍA DE APRENDIZAJE ACTIVO: UNA  
EXPERIENCIA VIA PBL EN LA UNIVERSIDAD DE  
BRASILIA-BRASIL**

*AN ONLINE EVENT AS A PRODUCT OF THE ACTIVE  
LEARNING METHODOLOGY: AN EXPERIENCE VIA PBL  
AT THE UNIVERSITY OF BRASILIA-BRAZIL*

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**RESUMEN**

El objetivo de este estudio fue sugerir una alternativa para gestionar el conocimiento y legado de la aplicación del método PjBL en la educación superior. Los legados del método PjBL no son sólo aquellos relacionados con la experiencia de los alumnos y los proyectos entregados a los agentes externos (colaboradores del curso de Ingeniería de Producción de la UnB) con las soluciones a los problemas reales, ellos son más profundos y diversos. El curso de Ingeniería de producción adopta desde 2011 el método PjBL como metodología activa de aprendizaje. A pesar de que cada semestre es una nueva experiencia en cuanto al proceso de consolidación del método, se percibe que muchas fases de este proceso y legado sólo se aprovechan en tiempo real, contribuyendo a los que están presentes en el momento en que ocurren, caracterizando como un legado temporal, sólo disponible en un momento "T" en

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el ciclo de vida de la disciplina. En un intento de extender esta experiencia y gestionar parte de este conocimiento del proceso que actualmente es perecedero, pues no es posible almacenarlo para futuros momentos, que el curso de Ingeniería de la Producción de la Universidad de Brasilia comenzó en 2016, una extensión por medio de eventos como el producto PjBL. Los resultados fueron satisfactorios con 458 alumnos y 7910 participantes. Como legado se obtuvo la creación de una plataforma de presentación de metodologías activas de aprendizaje para el intercambio de experiencias. Así, las presentaciones de trabajo que antes eran un marco puntual, pasan a formar parte de un legado por medio de un evento, asistido y accedido como memoria del curso y cartera digital del alumno.

## **PALABRAS CLAVE**

Metodologías Activas, PBL, Brasil, PBL, Evento, Tecnología

## **ABSTRACT**

*The objective of this study was to suggest an alternative for managing the knowledge gained and resulting legacy from the application of the Problem Based Learning (PBL) method in a higher education context. The legacies of the PBL method are found to be more profound and diverse than those related to either the students' experience or the projects developed to solve real-world problems presented by external agents (the partners of the UnB Production Engineering course). The Production Engineering course has, since 2011, adopted the PBL method as an active learning methodology. Although each semester presents new opportunities in the process of consolidating this method, it's been perceived that the many phases and results of this process are often utilized in real time only, contributing to the participating individuals exclusively as they occur. This is seen as a type of temporal result, seen only at a given "T" moment in the discipline's lifecycle. Correspondingly, part of this knowledge is currently seen as perishable, since it is not possible to store it for future moments. In an attempt to extend this experience, starting in 2016 the University of Brasilia's Production Engineering course has begun to develop an extension of PBL products by means of distinct events. The results haven been satisfactory, thus far involving 458 students and 7910 participants. As a legacy, it was possible to create a platform for the presentation of active learning methodologies and the exchange of experiences. Thus, the project presentations, once seen as distinct landmarks, became part of a legacy through a specific event, assisted and accessed as a course memory and a student's digital portfolio.*

## **KEYWORDS**

*Active methodologies, PBL, Brazil, PBL, Event, Technology*

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## **INTRODUCTION**

To discuss the context of contemporary higher education is to understand the current environment in which university courses are immersed, which is notoriously influenced by technology, real-time connectivity, and the large number of options offered to students. The improvements made in the last 25

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years have not only expanded the scope and depth of knowledge, they have opened up new possibilities for interdisciplinarity, as well as the adoption of new tools for the practical exercise of such knowledge. However, in this expanded context, there seems to be a consensus that the conventional education model is not enough to prepare individuals for the complex professional performance level expected in the modern world (Hake 1998, Sanchez & Maria 2017).

In an attempt to respond to the new demands of a differentiated reality, new educational models have emerged. Among the various active learning techniques, the Problem Based Learning (PBL) method has been highlighted as a distinct learning approach which integrates the knowledge of “how to know”, “how to do”, and “how to be” (Santos et al., 2010).

Although the results of PBL have been proven in several areas of knowledge (Blackburn, 2017; Zhou, et al., 2016; Gunter & Alpat, 2017), with relation to Engineering courses, traditional curricula is still characterized by weak interdisciplinarity, with the late integration of curricular components between theory, practice, and the academic and professional worlds (Escrivão Filho & Ribeiro, 2009). In this context, the Production Engineering (EPR) program at the University of Brasilia (UnB) has, since 2011, adopted the PBL method via course projects in eight of its Production Systems Project disciplines. Each of these is based on an anchor course, which provides students with the necessary competencies to solve a given problem, and to deliver a project (as a product) to external agents, who are initially responsible for presenting the class with real-world problems, drawn from their own experiences in their respective organizations.

In previous years, EPR and UnB have been offering project-based solutions to agents operating in various spheres (in public or private service providing organizations, large, medium and small industries, among others), with a high implementation rate in participating organizations.

However, the results of the PBL method are not only those related to the students' experiences, or the projects and solutions to the real-world problems delivered to external agents; they are more profound and diverse, as they originate from the interactions among the members of each team, in the development of each step of their projects, and in the presentations of their final products. Although each semester brings new experiences in the process of consolidating this method, it's been perceived that the many phases and results of this process are often utilized in real time only, contributing to the participating individuals exclusively as they occur. This is seen as a type of temporal result, seen at a given "T" moment in the discipline's lifecycle.

In an attempt to extend this experience, as well as to manage a part of its knowledge, currently seen as perishable (since it is not possible to store it for future moments), the UnB's Production Engineering began, in 2016, to develop a project extension via an online platform. This platform aims not only to broaden the scope of the results seen, but also to facilitate the exchange of ideas, and to promote greater interaction between universities that have adopted different active methodologies.

Thus, the purpose of this article is to suggest an alternative for managing the knowledge and results produced with the application of the PBL method in higher education. The methods of exploratory study and observation have been adopted, based on interviews and the experience of the professors responsible

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for the implementation of the online platform used for integrating the Program's results.

## LITERATURE REVIEW

### Active Methodologies

Over the years, higher education institutions have faced many changes. According to Morán (2015), traditional methods, which favored the transfer of information exclusively by teachers made sense when access to such information was difficult. Technology has since brought about the integration between time and space, where learning and teaching happens in a symbiotic interconnection. From this perspective, the student assumes an important role in the learning process itself. It is therefore possible to establish an active methodology, which is centered on the student, where their learning process is the main focus, and where the teaching process no longer receives center stage (Araujo, 2016). Thus, active methodologies are seen as a joint discovery process between teacher and student, where it is not clear if the answers will be found in all cases, as the search process is much more important than the actual results.

Although many institutions have experienced the same changes brought about by technology and information, some authors have sought to present solutions that integrate these new realities with existing learning needs. In Fig. (1) it can be observed that many methodologies are being applied to the new reality of education, though all of them depend on the student's involvement in the acquisition of knowledge.

**Figure 1. Active Methodologies**

<p style="text-align: center;">Inquiry Learning</p> <p>A constructive methodology of active teaching, where curiosity is the driving force of learning, based on research in four progressive levels.</p> <p style="text-align: right;">Banchi e Bel (2008)</p>	<p style="text-align: center;">Case-Based Learning</p> <p>An active teaching methodology that explores realistic and specific situations, where different conclusions can be reached.</p> <p style="text-align: right;">Monteiro et. al.(2012)</p>	<p style="text-align: center;">Just-in-Time Teaching-JITT</p> <p>A teaching and learning strategy based on the interaction between an active learner and Web-based study activities, where the student should prepare for classes through abstracts and exercises, among other tools.</p> <p style="text-align: right;">Novack et. al.(1999)</p>
<p style="text-align: center;">Collaborative Learning</p> <p>An active teaching methodology, where students, in groups, learn about the same ideas. The diversity found among students is seen as an enriching factor.</p> <p style="text-align: right;">Smith &amp; MacGregor (1999)</p>	<p style="text-align: center;">Cooperative Learning</p> <p>A cooperative learning approach very similar to the Collaborative method; however, while the task, in Collaborative learning, is assigned to a group, in Cooperative learning each element of the group is responsible for a specific activity.</p> <p style="text-align: right;">Smith &amp; MacGregor (1999)</p>	<p style="text-align: center;">Project-Led Education</p> <p>An active methodology in which teaching may occur at different levels, by the degree of substitution of traditional teaching subjects.</p> <p style="text-align: right;">Helle, Tynjala &amp; Olkinuora(2006)</p>
<p style="text-align: center;">Problem-Based Learning</p> <p>An active teaching methodology, in which students learn about a particular subject based on the resolution of complex, multifaceted and realistic problems.</p> <p style="text-align: right;">Helle, Tynjala &amp; Olkinuora(2006)</p>	<p style="text-align: center;">Project-Based Learning</p> <p>Project-based learning (PBL) is a teaching methodology that promotes learning through student participation in project teams, offering complex real-world problem solving.</p> <p style="text-align: right;">Oliveira, et al. (1998)</p>	<p style="text-align: center;">Bibliometric-Based Learning</p> <p>An active methodology based on the use of bibliometrics, in which students conduct research using advanced tools, such as the Consolidated Meta-Analytic Approach Theory-CMAAT, with multiple approaches for a given content.</p> <p style="text-align: right;">Mello, et al. (2017)</p>

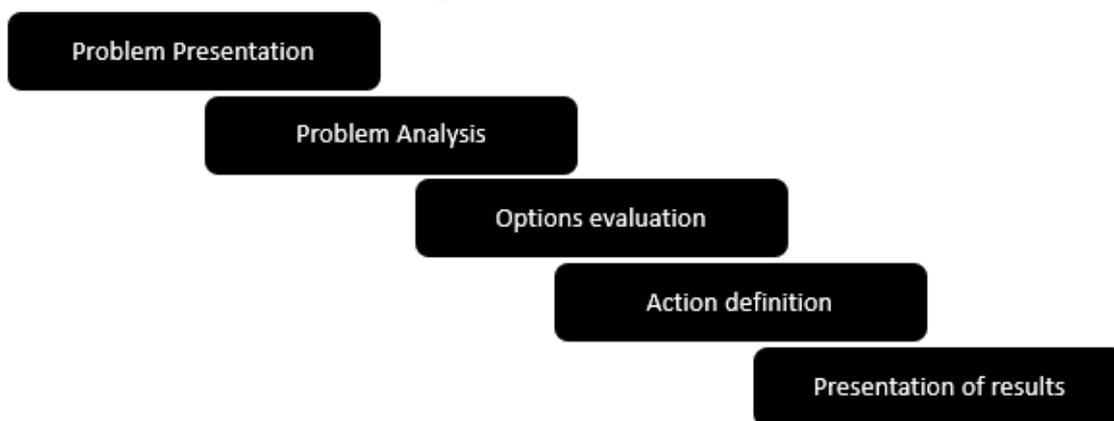
Source: Adapted from Monteiro et al. 2012.

### **Problem-Based Learning and Production Engineering**

The PBL constructivist teaching methodology is based on situations involving problems and was initially developed at Canadian medical universities in the 1960s. It was an attempt to train professionals who were more creative and critical, especially with regards to the challenges of real working scenarios. Although it originated in the healthcare field, PBL proved to be robust, and was later applied to other areas of knowledge, such as engineering (Angelo & Bertoni, 2012).

The PBL approach integrates theory and practice related to real-world problems presented to students, as an alternate way of bridging the gap between theory and practice (Frost, 1996). The process is simple, but it must be carefully planned. It begins by the introduction of a problem to a group of students divided into teams, typically consisting of up to 8 individuals. After receiving the problem, the students begin their analytical process, characterized by scientific research, access to secondary data and, in some occasions, primary data collected via questionnaires or interviews. This initial problem analysis process presents great opportunities for learning and serves to develop important skills such as autonomy and teamwork. With a more detailed analysis of the problem, the teams will begin searching for viable alternatives in order to offer solutions to the proposed problem, based on the literature and tools from their area of expertise. At this stage the decision-making process is developed. Once the plan of action has been defined, students begin the process of developing the chosen alternatives and monitoring the implementation steps. Finally, the actions' success is measured, and the results obtained are presented. Figure 2 demonstrates the steps of the PBL process applied to the Production Engineering course in the University of Brasília.

**Figure 2. PBL Process**



Thus, it can be seen that PBL is a method that develops an individual's skills through all of its stages. Hoffman et al. (2006) states that students trained via this methodology are more independent and perform a more efficient integration of theory and practice, which serves to prove the efficiency of PBL. In 2017, Zhou, et al., a meta-analysis with 419 studies was carried out, dealing with successful applications of PBL. For the purposes of designing the meta-analysis method, only 16 studies that had a positive statistical effect were studied. Thus,

qualitatively, 419 successful PBL studies were presented, and the 16 which were possible to evaluate statistically revealed an overall positive effect.

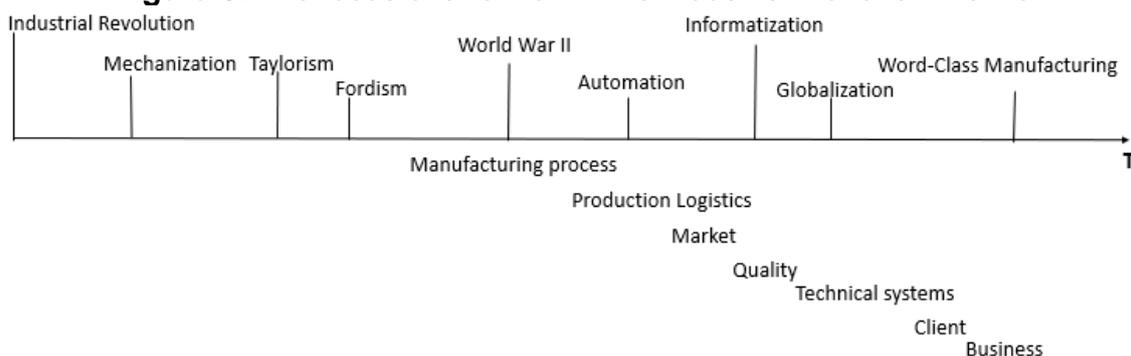
However, when one observes the PBL methodology from an engineering perspective, its adoption presents a noticeable challenge to faculties and to the courses' established cultures. Normally, engineering programs possess a sequential curriculum, where the introduction of basic sciences precede the applied sciences, with both followed by stage-based practice, resulting in a compartmentalized and linear structure (Escrivão Filho & Ribeiro, 2009).

Yet engineering has also undergone changes, as it has broadened its scope and specified some key areas needed to meet ever more dynamic societal realities. Traditional engineering (such as Civil, Electrical, Mechanics, Chemistry, among others) have been supplemented by others, more closely linked to new technologies (in the fields of Computing, Mechatronics, Aeronautics, etc.). These emerged in Brazil in the 1950s, with ITA and USP, followed in the 1960s by other engineering fields linked to healthcare and the environment and, finally, by those linked to management practices, such as Production Engineering, Production Processes and Work Safety in 1970 (De Oliveira, 2008).

According to De Oliveira (2008), activities related to management were always exercised primarily by engineers, and management-related disciplines were already a part of engineering post-graduate courses in the late 50's. In the 60's, they were being considered as part of the traditional engineering curriculum, finally being considered mainstream in 1970 at USP and UFRJ, and thus becoming the fastest growing programs in the overall field of engineering.

The growth of the Production Engineering programs is a reflection of a currently dynamic and changing professional scenario. It can be seen in Figure 3 how production systems have changed, with heavy machinery giving way to knowledge itself as the most significant capital asset used to obtain a competitive advantage. Allied with the problem-solving nature of engineering, this has transformed production engineering into an area of knowledge with all of the necessary characteristics to serve the modern marketplace (De Oliveira, 2005).

**Figura 3.** The focus of attention in the industrial world: a timeline

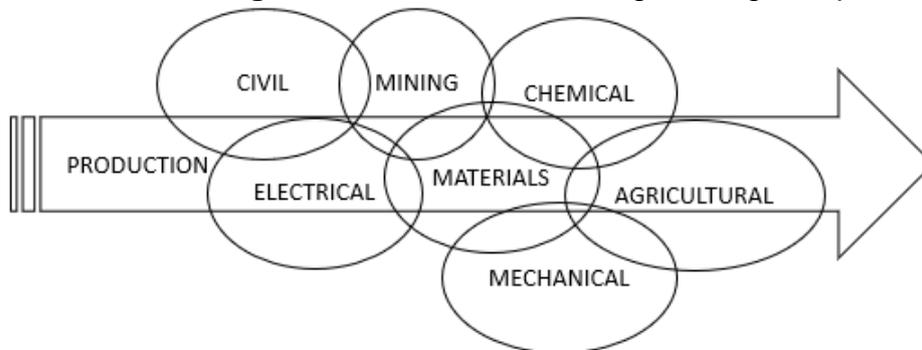


Source: Cunha (2002).

It is important to understand that Production Engineering, as well as Environmental Engineering, possesses a transversal nature with regards to knowledge areas presented in other engineering fields, thus adopting a flexible and dynamic characteristic. De Oliveira (2013) states that Production Engineering is present in several different contexts, as well as in the life cycle of products and enterprises resulting from other engineering fields, protecting its

identity and the nature of engineering knowledge. Fig. (4) presents this relation between the engineering fields and the transversal nature of Production Engineering.

**Figure. 4.** A schematic of Engineering disciplines



Source: Adapted from: De Oliveira (2009)

Thus, it can be seen that Production Engineering possesses transversal features that present unique challenges with regards to their integration into a typical engineering curriculum. This perspective results in a strong need for a practical component in programs that present these characteristics, so that students may understand their work space and the usefulness of their profession. The needs of programs that possess this type of knowledge -related transversal nature can be met with the use of active methodologies, such as PBL. The method's integrative character of theory-practice means that it can be adherent to the proposal of these programs, by permeating different knowledge areas for solving problems, and by positioning the student, still in training, in an environment similar to the real world.

### **Project-Based Learning in the University of Brasilia's Production Engineering program**

The CGEPR/FT/UnB Pedagogical Project is fundamentally based on a Problem-Based Learning model, with Solutions via Projects, focused on the production of services in sustainable production systems.

The adoption of the project-based PBL variant took into account some of the specific needs of the CGEPR/FT/UnB program. The first is related to the program's specificity, as it is configured as a service-oriented production Engineering program. Careful consideration was given to the realities of the city of Brasilia, which possesses a large service-oriented labor environment, as well as the ongoing changes in this market. Typically, a product is seen as the union between goods and services, with customers typically expecting to purchase both at once. The resulting projects are a great opportunity to create a product for these service-oriented companies, as well as industry-focused organizations. They serve to define knowledge as a competitive differential, by applying concepts from the PMBOK (Project Management Body of Knowledge), from Agile methods, and various sustainability principles.

There are eight Production Systems Project (PSP1 to PSP8) courses, each worth two credits, and all of them focused on a sustainable project methodology. From a total of twelve CGEPR/FT/UnB semesters, starting in the fourth, students will develop increasingly complex curricular integration projects (PIC1 to PIC8).

The overall aim is to consolidate the methodological aspects seen in each PSP course with technical concepts introduced in other accompanying courses, as well as to focus each project's theme on the realities presented by External Agents.

It is worth noting the existing integration between the CGEPR/FT/UnB and the university's Master's program in Applied Computer Science (MPCA). Graduate students of that program's Risk Management research line will act as External Agents, as their dissertation research topics will necessarily be related to a real-world problem originating from their own organizations. The undergraduate PSP students will thus perform various data consolidation activities under the supervision of the MPCA graduate students. These, in addition to receiving the activities' results, are expected to perform the fundamental task of tutoring (teaching) the team of undergraduate students.

The PSPs (Production Systems Projects) are carried out in teams comprised of 4 to 6 students. Each team attends to an external agent, who introduces a real-world problem to be solved, and a final deliverable in project format will be presented. Although many of these studies have been published in scientific and specialized journals, there are steps that were not materialized as final temporal products, such as the presentations and interactions at the time of final delivery, which occurred only within the classroom itself. Therefore, there was a need to take advantage of concepts related to projects and sustainability, as well as their results and benefits to society, in order to create a new event-based extension.

### The Event as a PBL product

When the term "event" appears in literature, a first impression may relate it to a festive, or commemorative, occasion. However, an event can also be considered a strategic instrument, the sum of previously planned actions, with the objective of achieving defined results for its target audience (Canton, 1997).

An event can relate to different perspectives, and serve different purposes. Its flexible conjuncture allows it to be configured for different uses in a Production Engineering context as well, in relation to concepts already adopted by this area of knowledge. When observing this integration between events and PBL as a Production Engineering teaching method, it is perceived that they share a similar structure, in a value-generating relationship.

Thus, an event can be characterized as an unique temporary system which, although terminated shortly after its completion, usually leaves legacies to be explored. This is similar to the concept of a project, which is "a temporary effort undertaken to create a product, service or unique result" (PMBOK, 2013, p3).

In combining these two concepts, a hybrid structure is obtained, as seen in Fig. (5), which presents the two phases of an event's lifecycle: (i) development, which corresponds to the lifecycle of the event's project; and (ii) exploration, which relates to the results of the event, in terms of the lessons learned in the project and the evaluation of the project's legacies.

**Figure 5. Stages of an event's execution**

Event Lifecycle

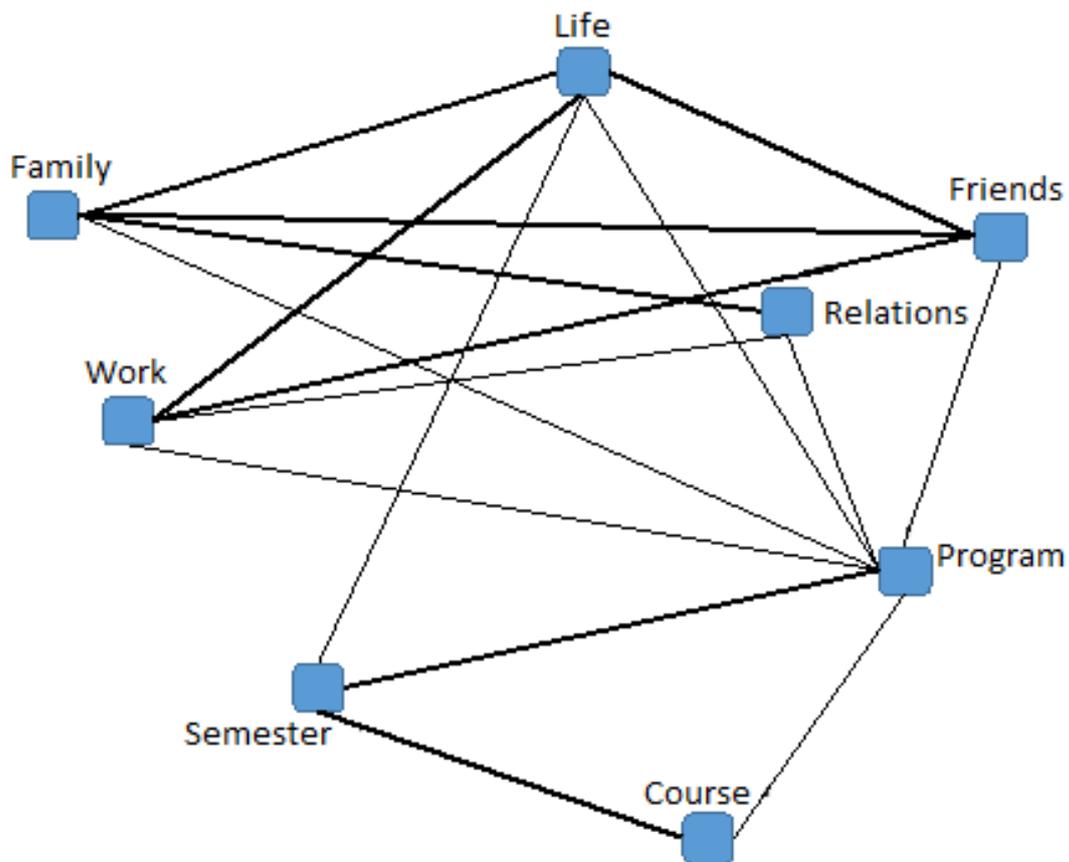
Development (Project)						Exploration (legacies)					
Pre			Launch			Pre			Launch		
Initiation	Conception	Assembly	Opening	Realization	Closing	Initiation	Conception	Assembly	Opening	Realization	Closing

The PBL method favors the integration of theory and practice through projects, and provides students with a more solid foundation. However, the learning process, which is seen as being as important as the result itself, is sometimes neglected from a legacy standpoint. It is often seen as a one-off milestone, making it difficult to transfer the resulting knowledge to other future teams, professionals, or interested parties. The events perspective is very clear as to the development of legacies and their value to the event itself. In this way, in addition to the products usually delivered in PBL in CGEPR/FT/UnB, the delivery of a consolidated event was seen as possible within an online platform, making it possible to interact with other institutions and stakeholders with regards to the solutions presented by the teams. This would, in turn, become a way to manage knowledge itself as a legacy, which would be available for future stakeholders, and become a part of the CGEPR/FT/UnB students' portfolios.

Based on these concepts, the final team project presentations from three of the courses of the Undergraduate Production Engineering Program in the Faculty of Technology of the University of Brasília (CGEPR/FT/UnB) were considered as events, with two main objectives: (i) to evaluate the final projects; and (ii) to take advantage of the opportunity to publish, in a virtual platform, the results observed in these disciplines by applying the PBL approach in the CGEPR/FT/UnB Pedagogical Project, showcasing an additional legacy of adopting PBL as an active learning methodology.

Correspondingly, it is possible to suggest the adoption of the "event" as a product of an active PBL methodology. In a graph theory perspective, Figure 6 introduces a representation of the individual through a few events of his or her life, and the relationship between each event. Nodes are seen as events, and the bonds are represented by relationships, where the thicker and darker the line, the stronger the existing relationship. Thus, each discipline is observed as an event, as well as a college or university program, as well as the student's own environment, such as family, relationships and friends. Some of these events, such as life itself, family, and friends, are represented by greater numbers and stronger relationships, as shown by the darker links. Evidently each discipline, in the context of a full semester, possesses a strong relationship, although in the context of an overall program, this relationship is seen as weaker. However, a student usually only experiences one undergraduate degree, but many semesters and many more disciplines. Therefore, it can be understood that each link between courses and the program is an  $X^n$  relation, where  $X$  is the strength of the relationship and "n" is the number of courses a student needs to complete in his or her program in order to conclude it.

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**Figure 6.** Relationships among events

However, the belief that a group of courses characterizes the overall program itself is a somewhat complex proposition, as each discipline involves a different set of contents, a development of different skillsets, distinct teachers, among other elements, making it a much more complex equation. But treating a course as a micro event within a larger event perspective, which in turn is part of a still larger event, is feasible, as this would entail working on two important concepts related to events: planning, and legacy. If each course obeys the planning stages of its event, and guarantees that its legacy will be available for the next event or course, a successive chain reaction occurs, strengthening the individual's network of events and thus aiding them towards becoming a more well-rounded professional.

## METHODOLOGY

### Sampling

This exploratory research adopted a qualitative approach. It took place in the city of Brasilia, Brazil, more specifically in the Production Engineering Program, which is a part of the Faculty of Technology of the University of Brasilia, in Brazil's Federal District. The University of Brasilia (UnB), oversees approximately 154 undergraduate programs and 152 Stricto Sensu programs, divided into 14 faculties. It currently serves over 40.000 students and approximately 2.695 career academic staff. The Production Engineering program is the only UnB engineering course scheduled in the evenings, with over 600 students, and is divided into 12

semesters. The event was defined as a product for three of the program's courses, in order to evaluate its potential as a legacy of the resulting projects. Three out of the four courses which participated in the event applied a Hybrid PMBOK/Agile method, with only one course applying a standalone Agile method. With regards to the PMBOK model, special emphasis was placed on documentation, as advocated in the guide's Initiation and Closing process groups. As for the Agile method, a main focus was placed on the iterative process and the possibility of value aggregation, covering the entire spectrum starting from each particular discipline to the network as a whole.

The methodological project course (Production Systems Project 1 - PSP1) is preceded by two prerequisite courses (Value Formation in Production Systems – FVSP, and Production Systems Project Methodology - MPSP), which include the delivery of reviews of publications focused on sustainability, developed as team projects. From this interweaving connection, a possibility emerged for creating an event, used to evaluate the final projects of each course, as well as the dissemination of their PBL results via a network. A mapping of the complete structure of the PSP1 course was necessary, in order to enable a broader understanding of the process.

The PSP1 course, as the initial basis for the implementation of further PSPs, is the only course out of the total eight planned PSPs that, while serving as a methodological anchor, also delivers content related to project methodology, sustainability, and data processing tools. It also addresses topics linked to systems and models, human interaction and coexistence, cognitive ergonomics, information research in knowledge bases, information consolidation, ABNT technical formatting norms, team behavior, and sustainable project methodologies. All of these elements are seen as necessary to contextualize these topics as a whole. In summary, as a response to the needs of students, who must learn to deal with problematic situations with a focus on databases, this course aids the individual in addressing these challenges via team projects, focusing on the exploratory analysis of data, the search for information in databanks with the use of spreadsheets, and other business intelligence platforms.

Based on the need to understand the foundations of sustainable projects, the MPSP course assigns students the task of producing, in teams, summaries which have these types of projects as central themes. To understand other issues related to sustainability, students of the FVSP course are also assigned similar tasks.

The PSP5 discipline aims to facilitate the development, by students, of projects that relate to real-world problems, and involve technical concepts introduced in the "Quality Management in Production" anchor course, as well as other integrative disciplines. In addition to acquiring technical knowledge, a further proposal of this course is for students to assimilate transversal concepts that can be acquired through the principles, methods and techniques of teamwork, project management and sustainability, which are encouraged to be incorporated into the proposed solutions.

Two main events were evaluated, each representing a semester (2016.2 and 2017.1), with 458 students involved in all of the related courses over the two semesters.

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### **Data Collection**

The results were collected in two stages. The first occurred in December 10, 2016, which included the results of projects started on August 9, 2016, and finalized with the execution of the event and its conclusion on December 13, 2016. The due date set for the second event was June 28, 2017, involving the results of projects initiated on March 7, 2017 were collected, concluding with the execution of the event and its completion on July 5, 2017.

The adoption of the event as a PBL product was possible by a video recording made by each team, who presented a summary poster containing the results for their assigned problems. The recordings had an open format, although a degree of formality was required in their presentation. These videos were sent to a platform which hosted a fully online event, with the participation of over 20 Partner Universities, whose members had previously confirmed their attendance.

Three versions were requested for the videos and posters: (i) a version containing audio and the poster itself in English, with Portuguese subtitles; (ii) a version with Portuguese audio, with the poster's text and subtitles in English; and (iii) a version with both audio and video in Portuguese, without subtitles. In order to participate in the *1st Event of Network Diffusion of PBL Outcomes*, at first only videos and posters adhering to formats (i) and (ii) were selected, though later all three formats were accepted. The platform was developed via a web page, with the domain [www.eventndo.com](http://www.eventndo.com), under the name "*I Event of Network Diffusion of PBL Outcomes*" for the second semester of 2016, and "*II Event of Network Diffusion of PBL Outcomes*", for the first semester of 2017.

### **Data Analysis**

Data analysis was based on the evaluation of courses' results, in which different delivery types were required from students. The events' results were also evaluated, along with the content of the video presentations, and the summaries and final reports. Therefore, the analysis of the data begins from the starting point of each course, its expected deliverables, and on to the planning stages and presentation of the final versions of the videos, summaries and reports.

### **Course planning**

Developing an event resulting from the application of an active methodology requires an initial planning stage. At first, teams will follow the PMBOK Guide's Initiation Process Group, which is concerned with the formalization steps needed to begin the project, via the Project Opening Statement, as well as the identification of the project's Internal and External Stakeholders, which will influence the project's overall results.

Initially the Project's Opening Statement is developed, which is an element contained in the Integration Knowledge Area. This document will formally authorize the project's existence, and gives the project manager the necessary authority to devote organizational resources to the project's activities. The main benefit of this process is the development of a well-defined set of project starting activities and scope, as well as the creation of formal project records, being a direct way by which the executive decision makers can accept and formally commit to the project. The five inputs of this process are: (i) The Specification of the project activities; (ii) the Business Case; (iii) the Formal Agreements; (iv) The

definition of the company's environmental factors; and (v) the organizational processes' assets; while the only output is (1) the Project's Opening Statement. Secondly, the teams will establish a line of contact with their external agent, and thus identify the Knowledge Area Stakeholders, in a process which serves to identify individuals, groups or organizations that may impact, or be impacted, by a decision or activity. This process also involves analyzing and documenting relevant information regarding the Stakeholders' interests, their level of involvement, their interdependencies, their influences, and their potential impact on the project. The process possesses four entries: (1) the Project's Opening Statement; (2) The Acquisition documents; (3) The description of the company's environmental factors; and (4) the organizational processes' assets, and a single output: (i) The list of Stakeholders.

Once the groups' tasks are initiated via the definition of project's Opening Statement and the identification of stakeholders, the teams began their work by researching and meeting their external agents. For each course, an end product is expected. The description of the final deliveries was the first element to be altered in the courses which adopted the use of events as a PBL product. Video presentations of project-based solutions were adopted. Distinct deliverables were required for each course, considering the autonomy of the professors. The videos themselves were seen as the unifying elements of the overall project, as they made possible the exchange of information between courses. The expected results were defined as follows:

- **Production Systems Project 1**

For each Team (16): (i) A Briefing written in ABNT format, containing three mandatory appendices (a record of Lessons Learned, a Matrix for Identifying Agility, for each PMBOK process, and a listing of all Aspects related to sustainability); and (ii) A video presentation, of up to 15 minutes, showcasing a poster summarizing the team's efforts.

For each Subject Leader (8): (i) A Briefing written in ABNT format, containing an Executive Summary of the work performed by both teams that were assigned a specific Subject; and (ii) A video presentation, of up to 15 minutes, showcasing a poster describing the Executive Summary of each Subject.

For each Research Item Leader (4): (i) A Briefing written in ABNT format, containing an "Executive Summary of Executive Summaries" related to both of the Research Item's Subjects; and (ii) A video presentation, of up to 15 minutes, showcasing a poster describing the Executive Summary of the Research Item.

- **Production Systems Project Methodology**

For each Team (12): (i) A Briefing written in ABNT format, containing three mandatory appendices (a record of Lessons Learned, a Matrix for Identifying Agility, for each PMBOK process, and a list of Questions for verifying the assimilation of the projects' content); and (ii) A video presentation, of up to 15 minutes, showcasing a poster summarizing the team's efforts.

For each Subject Leader (4): (i) A Briefing written in ABNT format, containing an Executive Summary of the work performed by the three teams that were assigned a specific Subject; and (ii) A video presentation, of up to 15 minutes, showcasing a poster describing the Executive Summary of each Subject.

For each Research Item Leader (4): (i) A Briefing written in ABNT format, containing an "Executive Summary of Executive Summaries" related to both of

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the Research Item's Subjects; and (ii) A video presentation, showcasing a poster describing the Executive Summary of the Research Item.

- **Value formation in production systems**

For each Team (12): (i) A Briefing written in ABNT format, containing two mandatory appendices (a record of Lessons Learned and a list of Questions for verifying the assimilation of the projects' content); and (ii) A video presentation, of up to 15 minutes, showcasing a poster summarizing the team's efforts.

For each Subject Leader (3) of each Research Item: (i) A Briefing written in ABNT format, containing an Executive Summary of the work performed by the four teams that were assigned a specific Subject and Research Item; and (ii) A video presentation, of up to 15 minutes, showcasing a poster describing the Executive Summary of each Subject and Research Item.

- **Production Systems Project 5**

For each Team (3): (i) A Briefing written in ABNT format; and (ii) A Project follow-up document, (iii) a scientific article and (iv) A video presentation, of up to 15 minutes, showcasing a poster summarizing the team's efforts.

The Subject and Research Item Leader approach was not adopted in the PSP5 course.

The decisions regarding the content of the video presentations and use of editing software was left up to each team, as a way to stimulate creativity and to get a sense of different approaches that could be later used as a standard for future editions of the event. The only predefined criteria were related to the duration of each presentation, and the spoken language and subtitle formats, which were considered essential for defining both the total running time and target audience for each event (as in this case, many foreign Universities were expected to participate).

The results were delivered by students via the Moodle platform, with the exception of the video presentations, which teams were instructed to upload to a personal account on the free YouTube platform. After the content was uploaded, the team leader was expected to send the link to the professor via email. After receiving the link, the professor would include the downloaded file into a database of finished presentations.

### **Event project**

In order to transform each product into an event, two prerequisites needed to be met: the definition of both an overall schedule and a venue. The schedule was defined by considering the courses' evaluation criteria, in order to take advantage of the knowledge generated in the process of delivering each project, and to avoid unnecessary effort on the part of the students. The event was set to last three days, one for each course, thus ensuring that each day's content, although interconnected, would be somewhat independent.

The first day was set aside for the content of the PSP1 course, while the content for MPSM was assigned to day 2, and the third day designated for the FVSP and PSP5 courses. As each team was responsible for separate subjects within each course, it was decided to hold the presentations in different rooms. Although the final schedule was set, a number of important issues still needed to be resolved, revolving around organizing the venue itself, and ensuring the participation of students and other stakeholders. Further concerns were related

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to upcoming holidays, as well as negotiating the release of students from other ongoing classes, which were scheduled for the same dates as the event.

To address these issues, it was decided that the event would be held entirely online, allowing for both students and interested parties to attend from the place of their choosing, using their computers, tablets, or even smartphones. The chosen platform was the website [www.wix.com](http://www.wix.com), which held information regarding the event itself, dates, and main topics. To simulate the different presentation environments, participants were provided with separate password-protected links in order to access the video content. In parallel, a publicity campaign was held with collaborating universities, with students being made aware of the event and urged to participate. Over 30 universities received access to the videos, as teachers encouraged their students to attend the event. A Facebook page (available at <https://www.facebook.com/II-Event-of-Network-Diffusion-of-PBL-Outcomes-710796052429798/>) was created, serving to further publicize the event, which included a live feed airing the event's ongoing preparations.

The video content uploaded by students was organized into YouTube playlists, which contained a forwarding link to the event's homepage ([www.eventndo.com](http://www.eventndo.com)). On the website itself, a chat function was included in order to encourage discussion between the event's participants, with a registration link made available in order to facilitate the later delivery of participation certificates.

## RESULTS

The opening of the *I Event of Network Diffusion of PBL Outcomes* occurred on December 13, 2016, and the *II Event of Network Diffusion of PBL Outcomes* occurred on July 5th, 2017. On each opening date, two student representatives for the courses selected for the pilot were responsible for welcoming all participants, and later for giving the floor over to the professors, who would describe the event's features and the overall PBL structure of the University of Brasilia's Production Engineering program. This opening process, lasting a maximum of thirty minutes, was repeated on each subsequent day, with minor variations. Following the professors' opening remarks, video posters would serve to generally outline the content available in each of the "rooms", with each participant receiving a brief summary of the main topics, being able to choose which room they would like to connect to. The opening remarks and video posters were made available in three languages: Portuguese, Spanish and English.

Each room followed the set schedule, showcasing the explanatory videos from each participating team. On the last day, a closing message for the event was created, thanking all individuals for their involvement. After a period of 48 hours, the participation certificates were made available.

The video content was viewed by approximately 1300 users over the course of the event, with the results of the 2016.2 edition's projects being accompanied by a total of 3902 individuals from 5 different countries. The 2017 edition was viewed by over 2000 users from 9 different countries. The results were satisfactory in all respects. With the prerogative of furthering education, a new product was created, based on knowledge management principles, which enabled a level of interaction between a network of different universities, resulting in a productive exchange of experiences. From a legacy standpoint, it was possible to create an ongoing platform for the presentation of active learning methodologies, not only for the courses involved in the pilot, but also for other

areas of the department, college, and university, as well as other agents interested in disseminating their results. The project presentations themselves, once considered as distinct landmarks, became part of a legacy by means of an event, viewed and accessed as a memory of the course. They became a part of the students' digital portfolios, which they can now connect to and use to showcase their contributions and developments to other stakeholders. From the students' perspective, this new challenge was embraced and accepted with broad participation, and improved by the interaction with other individuals from different universities. For students in previous semesters, the accomplished results serve as a guide of what is to be expected for their own presentations. In a national and overall South American educational context, this served as an opportunity to present the event to a previously unreached international audience, integrating teaching methods through technology. For countries with greater event trajectories, such an initiative may seem limited in scope, but for the 112 participants in Sucre, Bolivia, or the 920 viewers from Itabuna and 102 from Buerarema, both cities in the Brazilian state of Bahia, it was a notable occasion.

Thus, the idea and development of an event as a PBL product serves to ratify all objectives linked to the active methodologies previously explained by Angelo & Bertoni (2012), Frost (1996) and De Oliveira, et al (2005,2008,2010,2013).

## **DISCUSSIONS, CONCLUSIONS AND IMPLICATIONS**

The objective of this study was to suggest an alternative method for managing the resulting knowledge and legacies produced via the application of the PBL method in higher education. To achieve this goal, an initial pilot project was carried out in three courses of the University of Brasilia's Production Engineering Program, with a resulting new product in the form of an "event". Students were required, in addition to their usual project deliveries, to also produce a video presentation that would be hosted on a digital platform. This, in turn, served as a basis for an entirely online event, attended by 3902 individuals in the second semester of 2016 and 4008 in the first semester of 2017.

The creation of this platform ensured that the overall objective was achieved, by making certain that the project presentations, previously limited to a fixed point in time, were made available for future access. They would serve as a reminder of the courses' results, as well as part of a portfolio included in the students' academic careers, as a way of managing knowledge previously lost to other stakeholders. The resulting legacy would thus serve to benefit all parties involved in the process.

The limitations of this study can be linked to technical issues pertaining to the construction of the broadcast platform, as well as those related to the speed of upload and download of the video content. As for future contributions, this experience is expected to be expanded to the other PSP courses, and augmented by similar results achieved from universities that have applied active methodologies. In addition, other universities have been encouraged to join these efforts, by contacting the professors responsible for the project via its main website ([www.eventndo.com](http://www.eventndo.com)).

## **DECLARACIÓN DE CONFLICTO DE INTERESES**

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Los autores declaran que no existen conflictos de intereses potenciales con respecto a la investigación, autoría y o publicación de este artículo.

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