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# Collaborative Learning Concept Implementation through Web.2.0 Tools: The Case of Industrial Engineering Fundamentals' Discipline*

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The development of the Internet has led to a great transformation in different spheres of society, including education. The question discussed in this research is not whether this transformation is positive or negative. This study aims to discuss the potentialities of Web 2.0 tools in education, observing how it can be used in Engineering Education models. The question that we want to help answer is: How can engineering professors use Web 2.0 tools, for example in a blog, in teaching strategies to create a motivational learning space? A methodology based on collaborative learning was proposed to students in the Industrial Engineering Fundamentals discipline using Web 2.0 tools to evaluate its potential to aid autonomous learning. It was concluded that Web 2.0 tools have a large potential in Engineering Education. This methodology created a space in which students have a more active role in the learning process.

**Keywords:** collaborative learning; industrial engineering; Web 2.0

## 1. Introduction

The diffusion of communication and information technologies stimulated a new way of thinking about the learning process, called collaborative learning [1]. This was driven by the development of the Internet, in which the concept of Web. 2.0 represents a paradigm shift in interaction viability. The Web 2.0 tools changed the way that Internet users interact on the network promoted by it. This evolution affects the pedagogical models, influencing how people organize and share knowledge [2]. The interaction can be considered to be a new form of thinking about the learning process, in which ideas are constructed by a group discussion on the network.

The contact of students with communication and information technologies is being increased by interaction tools, a fact verified by the increasing use of social networks and blogs, and other resources. The question discussed in this paper is. 'How can professors generate a motivational space in the classroom using Web 2.0 tools in engineering education?'.

To improve this discussion, this paper focuses on an experiment developed in a discipline of an industrial engineering course from a Brazilian Federal University. The first step is to contextualize the case.

The group analyzed in this research is composed of Industrial Engineering students who have previously reached Science and Technology bachelor degree level. These students only attend the professional disciplines at the fifth semester. This creates a problem for engineering courses: the lack of student understanding of an engineer's professional life. It also creates a demotivational environment, enhancing the possibility of circumvention. With the aim of solving this problem, an experiment based on collaborative learning with students from the industrial engineering fundamentals discipline was developed to enhance their motivation in the other disciplines of the industrial engineering course.

This paper is structured into three parts: the first presents the concepts of learning, motivation and collaboration, discussing how Web 2.0 tools can collaborate with the learning process. The second part shows the methodology used in this research. The last part presents the results of this study and the conclusions.

## 2. Learning and motivation

The teaching of engineering must be thought of in a less traditional way (sender–receiver model); a new approach, a progressive one, must be adopted, according to which the student constructs his or her concepts based on discussion and interaction [3]. In this process, learning does not take place only at an individual level, but is affected by social and environmental elements [4].

It is important to encourage contact among

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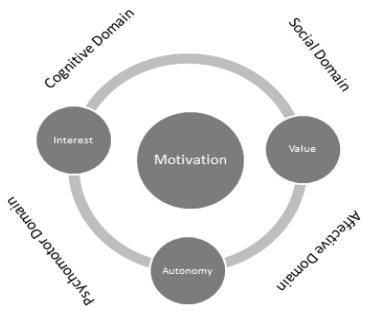


**Fig. 1.** The four-domain development diagram [4].

students, to stimulate them to work together through active learning, and the professor must provide prompt feedback, emphasize time on task, communicate high expectations, and respect diverse talents and learning styles [5].

The learning process can not be separated from these elements (environmental, cultural and social) and it must be observed in teaching strategies. These elements are called "Development Domains" and they are shown in Fig. 1 [4]. To be successful in the learning process, methodologies must observe these domains.

In Fig. 1, four Development Domains are shown. The first is called the Cognitive Domain and it is associated with the capacity to process information. The second is called the Psychomotor Domain and it is associated with the abilities got by individual practices [4]. These two first factors are considered the "internal factors" of the learning construction.

We can also observe in Fig. 1 the "external factors" associated with learning through external influences and interaction. These are the Social Domain and the Affective Domain [4]. These domains are extremely important to the learning process [6].

The internal factors are connected to the traditional engineering teaching model, which focuses on the technical area and requires much study and the development of working methods by the students. The external factors are seen as the new engineering abilities, characterized by engineers with critical thinking and understanding of the social and economic context.

These four domains are not the only elements needed in order to be successful in the learning process. There are the constructs connected to the students' motivation to learn. The first construct is called interest, which is associated with the capacity for fun and pleasure in the work development. The second one is the value, which is linked to the students' beliefs and evaluation of the content value to their lives. The last one is autonomy, like the evolution of interest, in which the student goes beyond the material made available by the professor [4].

These ideas are linked to the Learning Theory of Vygotsky: development and learning occur through the acquisition of content through social exchange, for example the exchange of information among people [6]. The construction of knowledge is a continuous process, being obtained by interaction [7]. This interaction, however, must not be restricted to the classroom and the student needs to transpose the university limit, where there is no professor. This student autonomy is a very important factor in the learning process. According to these authors, interaction is a very important element in the learning process, because it can generate autonomy in students. To reach this autonomy, the professor must encourage students to interact and, to do this, he or she can use the concept of collaborative learning. There are many tools that can help to implement this methodology.

## 3. Collaborative learning

Collaborative learning is pedagogical and the students must interact with each other and with the professor, as well as collaborating in the learning process [8]. This model encourages students to learn together [1].

Collaborative learning develops critical thinking and confidence, and it improves skills in interpersonal relationships, enhances motivation and shares the responsibility for learning [1, 9]. This kind of learning is linked to external factors [4].

The key issue for success in this learning model, therefore, is related to autonomy, and the professor must stimulate students to develop activities in this way, promoting interaction [4].

The partnership, here seen as interaction, is a necessary ability in the contemporary curriculum [10]. Thus, professors must develop this ability in students in order to produce engineers with this competence. Students/engineers must be capable of interacting and collaborating with each other in order to develop knowledge in enterprises, as illustrated in Fig. 2. Figure 2 explores the knowledge evolution in organizations.

The idea behind this concept is that knowledge is improved when interaction among employees occurs and generates solutions and innovation in enterprises. This fact can be transferred to pedagogical practices. A student's experience is called tacit knowledge and it is mixed with the other students' experiences and with the knowledge presented by the professor (explicit knowledge). This interaction generates a consolidated concept that is understood and constructed by the group.

Despite the widespread dissemination of these methodologies, transferring this concept to engineering education is not an easy task, because the

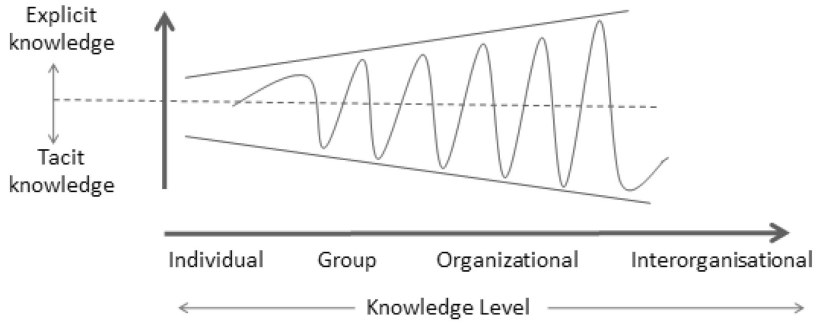


**Fig. 2.** Knowledge evolution [11].

professor must change his or her attitude in the classroom and guide the students' learning. The professor is not the "knowledge holder". This represents a paradigm shift in engineering education [12]. There are many tools to help in this process and here we highlight the Web 2.0 concepts and tools.

### *3.1 Web 2.0 and education*

The Web 2.0 can be defined as the second generation of on-line services that amplify the spaces of interaction between different people in the form of sharing, publishing and organizing information on the network, called social technology [12]. These on-line services characterize the contact with a great deal of information and different languages inside the cyberspace. The student has the autonomy to learn what is worth looking at and is interesting [13].

In this second stage of the web, participation is stimulated and a large amount of information and knowledge output is generated [14]. Its potential can be explored in the educational context through spaces for processes of collective work, information production and circulation, and the social construction of knowledge supported by information technology. In this sense, many tools can help in this process, such as the Web 2.0 tools.

These resources can be used not only to make the class more interesting, but to be part of contemporary pedagogical practices: the development of independent learning and research skills in students [15]. In the learning process, it is linked to the active participation of the student, who must be motivated to generate the autonomy to learn.

It is a challenge for professors to use these tools to generate motivation in students. It is very important to promote the technological literacy of the professors in two areas: the language interpretation of technology and technical manipulation of technologies [15]. Professors also need to understand the pedagogical possibilities of information and communication technologies in education [14].

Some of these possibilities are presented below; the blog represents Web 2.0 philosophy because of its interactive features.

### *3.2 The blog as a pedagogical tool*

The evolution of the Internet and its tools enabled a new Internet user phase in which everyone can be the author and produce his/her own information. This stage is known as Web 2.0. An example of its evolution is the web-blog, which is a logbook.

The blog first appeared in the late 1990s: it was a logbook for thinking, reports, and the sharing of personal reflections, but it required a knowledge of programming. In 1999, web-blog services were created, such as "Blogger" from Google, for example. This system is free and it makes web-blog dissemination easier.

The blogs are web pages that are chronologically organized like a diary. It is possible to post images, texts or other files on the pages [16]. There are spaces for users' comments and the reader can have a discussion with the blog's author. This kind of resource promotes interaction and collaboration among users. In this case, the readers are authors too, putting forward their ideas and complementing a concept [17].

Because of the possibility of interaction and collaboration, the blogs are used for many objectives: personal diaries, entertainment and pedagogical practices, among others. It is important to highlight the fact that a blog is a democratically valued space for the collective construction of knowledge, which is available on the network to other Internet users [18].

In the blog, the student presents a more reflexive attitude and contextualizes the subjects presented with other websites (hypertext). He/She can interact better with other students and with their professor, and have an active attitude towards the learning process [19]. There are some elements that are necessary to make the blog a potential tool for education [20].

- The students must stimulate other students to discuss the concepts developed in the blog to generate feedback, resulting in the students' self-motivation.
- The students must use different forms of communication, such as videos, texts, audio, and other tools.

The blog can be used like a resource or strategy. We can consider it a resource when it works like a space to promote access to specialized information posted by professors. As a pedagogical strategy, the blog can be used like a portfolio, in which students can post their experiences or their works, and a space for interchange, collaboration and discussion. These two possibilities are the focus of this research [11].

We can observe some examples of blog use in education. There are some educational blogs to teach physics and chemistry. They are organized by students and guided by professors. The students do research about the subject showed in classroom; they develop texts and construct the blog's. Examples of blogs can be accessed at http://fisicaporquenao.zip.net and http://quimicaparaoenem.zip.net, where they are used like a meeting place. There, the students check their homework, they access news about the subjects, find some links to other sites and interact with students and professors to post texts, images, comments and messages [21]. The knowledge was constructed by group work and supported by collaborative tools [22].

In these cases, the blog was used as a resource and like a pedagogical strategy because its function was to provide an information access space constructed by students. It created a sense of autonomy (key concept proposed by [4]). On the other hand, it works like a space for interchange, discuss, integration and collaboration.

The blog can also be used to promote the students' sense of responsibility in their work and the sense of contribution to the world because their production is available on the network [2]. These characteristics are also explored in this research.

In higher education, especially in engineering, there are not many examples of blogs used as a tool for learning.

## 4. Methodology

This research presents qualitative elements because it is searching to understand a phenomenon through description, decoding, translation, and the interpretation of a process [23]. In this case, the phenomenon is the learning process in the engineering context, and the researcher analyses the process from his ideas [24].

In the learning process analyzed in this research, the students' autonomy in a situation proposed by the professor was observed. It will be discussed how the professor can stimulate motivation to study by using strategies and tools to promote student–student, student–professor and student–engineer interactions, based on the concept of collaborative learning. The blog was chosen to implement this experiment because it represents the concepts of collaboration, authorship, and autonomy—elements that are intrinsic to the core philosophy of Web 2.0 [14].

The method is based on documental analysis, interviews, participation, direct observation and introspection [25]. It is necessary for the researcher to be an element, a participant in the research and observe the impact of his/her influence in the studied process.

The first step of this study, the descriptive observation, analyses the methodology used by the professor and the course of the discipline. To have this information, a questionnaire with open and closed questions was used to understand the general context of the discipline. There are 30 students in the course. The questions are presented in Table 1.

Based on the answers obtained through the questionnaire illustrated in Table 1, it was defined that the focus in this study is the group of students enrolled in the Introduction to Industrial Engineering course. These students are in the fifth semester of the Science and Technology bachelor degree. This group did not know what the function of an industrial engineer was in the industry. Once this problem has been observed, an activity was proposed to the group aiming at improving the knowledge of students on the action areas of an industrial engineer. The students were divided into pairs.

The idea proposed was the creation of a blog and the students would be the authors of the blog's contents. The first group was responsible for the creation of the blog on the network. They were also responsible for the following activities:

- A historical survey of industrial engineering

**Table 1.** Diagnostic questionnaire

| |
|---|
| a) Define the main forms of an Industrial Engineer's activity in organizations. |
| b) Why did you choose the Industrial Engineering course? |
| c) How do you classify your motivation to the discipline introduction to industrial engineering? |
| d) Explain the reasons that led you to the previous answer. |
| e) How difficult are the contents in the discipline? |
| f) How do you evaluate the methodology developed by the professor? |
| g) Explain the reasons that led you to the previous answer. |
| h) How do you see the idea of using a blog as a tool for the development of the proposed work? |

- Developing a mental map listing all the areas of Industrial Engineering
- Presenting reports and interviews about the role of Industrial Engineer in organizations.

The other groups were responsible for each area of Industrial Engineering defined by the Brazilian Association of Industrial Engineering and they had to present some topics about these themes:

- How the area emerged
- Each topic of the area
- Interview an engineer who works in the researched area to identify his activities;
- Examples of applications of the tools related to the area studied. Each group had to follow the steps: problem presentation, the tools used to solve the problem, the solution obtained with the application of the tool, and evaluation of the benefits and problems of the tool application to solve the problem.

**Table 2**. Final questionnaire

| |
|---|
| a) Is there any change in the way you see an Industrial Engineer's work? |
| b) Characterize how was the change in the way you see the role of a Manufacturing Engineer. |
| c) Did you feel motivated with the proposed work? |
| d) Compared with the traditional teaching model, do you think the methodology developed contributed to a better learning? |
| e) List the problems you observed in the work proposal submitted by the professor. |
| f) How do you classify the interchange of information among the students? |
| g) How do you classify the activity proposed by the professor? |
| h) How do you see the idea of using the blog in the development of the work? |
| i) Do you think that you can contribute with the work developed by the other groups? |
| j) Do you think that the other groups can contribute to your work? |
| k) How do you consider your diligence in preparing the material published on the blog? |
| l) Why? |

The objective of the activity was to stimulate a more active attitude in students in the learning process and instigate their interests in investigation. This activity created a space to observe the students' attitudes in the proposed activity. It was also observed how the external factors [12] are influenced by the concepts of collaborative learning [8] by using the blog and its potentialities (sense of responsibility in producing the blog material) [2].

At the end of this task, a new questionnaire was given to the students in order to identify the effectiveness of the proposed study. This questionnaire is presented in Table 2.

## 5. Results and discussions

The Industrial Engineering course of the Federal University of the Semiarid Region (*UFERSA*) was created in 2005. In the first years, students entrance of done through an exam. In 2008, this changed, and access to engineering courses occured after the students had obtained their Science and Technology bachelor's degree (BC&T). In this course, students do not have much contact with engineering and they attend only the basic disciplines, like Chemistry, Math and Physics. However, in the fifth semester of the BC&T course, the students attend disciplines from the engineering courses in which they plan to enroll. In this case, the discipline is Introduction to Industrial Engineering.

It was observed that there was a separation of the content presented in classes from the engineering professional practice, and the students did not understand the importance of the basic disciplines

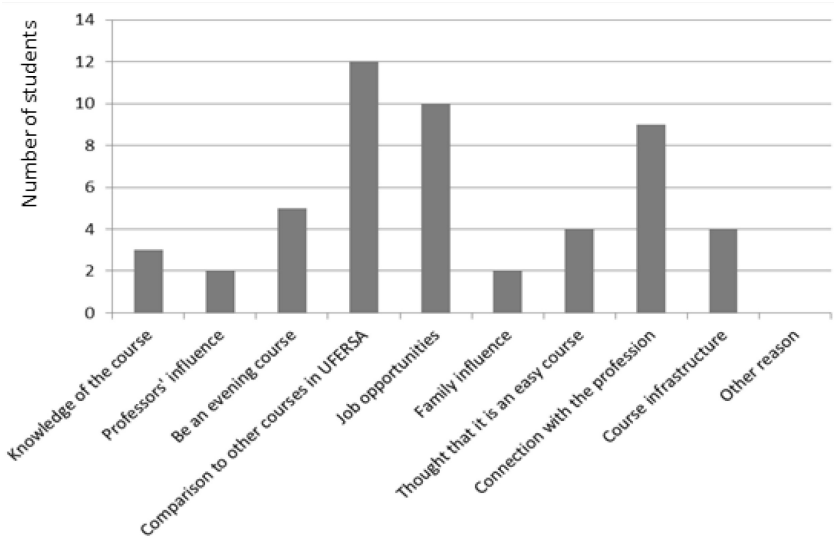


**Fig. 3**. Reasons for choosing the Industrial Engineering course.

needed to be an engineer. This represents a possible source of demotivation.

Figure 3 presents the most cited reasons for students to choose the Industrial Engineering course. The three most important reasons are: comparison with other engineering courses at UFERSA, job opportunities, and a connection with the profession. The reason for the first point is that the industrial engineering course has a good infrastructure and the students trust the course coordination. The second reason is the great coverage in the news of the good wage paid to the profession.

It can be observed, however, that most students did not know much about the industrial engineering course. This illustrates how ignorant they were when choosing the course. This fact was confirmed when the professor asked if the students knew the function of the industrial engineer in industry before they choose the course (just 59% said to knew the function of an industrial engineer before choosing the course). The students did not understand the importance of the disciplines.

In addition, many students classified the contents of the discipline as difficult to learn. Most students (82%) classified the contents of the discipline as difficult or moderate. This is because the themes are wide-ranging as this discipline covers all the areas in which an industrial engineer can work.

It is important to highlight that the students asked to know what an industrial engineer does. However, the professor found that the students had only a superficial concept about the role of industrial engineers and they could only give the names of some of the tools used by the profession. They did not understand how the engineer is placed holistically in an organization. This indicated a need to develop this knowledge in the students. Table 3 shows the students' statements about the activities of an Industrial Engineer.

Based on these answers, the professor concluded that they did not understand the function of an industrial engineer. Without this knowledge, the concepts presented in the course are decontextualized, which can demotivate students in their disciplines, resulting in a bad performance in the course. Because of this, the professor developed an activity to stimulate the interest of students to find out the industrial engineer's function in industry.

Before this study, the course content was presented by the professors and the students reproduced the content in programmatic evaluations. The problem with this methodology is that the content is wide-ranging and the students did not have previous contact with the industrial engineering world.

Therefore, the professor chose to work with these contents using the collaborative learning methodology in order to develop an autonomous attitude in the students. However, to achieve this goal, the students must be motivated to develop the proposed work.

For developing motivation, the mainspring of learning [12], the professor developed an activity based on field research using an interactive Web 2.0 tool, the blog. However, before the professor proposed the work, it was ascertained whether the students were familiar with the blog tool (41% had previously used a blog). It is important to identify this awareness because if students do not know how to use this tool, it can be a reason for demotivation.

The result obtained (all students considered that the use of a blog for the development of the work was excellent or good) confirmed the professor's idea on the use of the blog in the activity. It is a space for interchange among BC&T students and the industrial engineering world.

However, even if students use the blog, it does not mean that they know its potential. Students were asked how they used a blog. The most representative answers are shown in Table 4.

**Table 3.** Statement characteristic of students about an Industrial Engineer's activities

| Superficial definitions | Definitions related to specific areas |
|---|---|
| *This engineer is a problem solver . . .* (Student 1) | *He/she works in the demand forecast, making decisions related to production . . .* (Student 8) |
| *He/She works in production of goods and services . . .* (Student 6) | *. . . checking if the production process can be optimized . . .* (Student 19) |
| *He/She can work like a manager in some industry areas . . .* (Student 12) | *. . . programming the production line . . .* (Student 20) |
| *He/She supports decision making . . .* (Student 15) | |

**Table 4**. Statements characteristic of students' prior to using the blog

| Students who had previously used the blog | Students who had not used the blog |
|---|---|
| *Used only to consult the blog content* (Student 2) | *I see blogging as a way to mature my ideas that other people will see and make suggestions* (Student 15) |
| *I used the blog as a virtual diary* (Student 12) | *Extremely difficult, but rewarding* (Student 21) |
| *I have already had a blog for three years* (Student 20) | |


**Fig. 4.** Blog developed by the students (source: http://engproducaoufersa.blogspot.com).

From the students' statements, it can be observed that the blog was used like a Web 1.0 tool because the students did not explore its main possibility, collaboration. To use this and stimulate an autonomous attitude in students, the professor proposed a research activity. The students were invited to create a blog to understand an industrial engineer's function. Initially, the first group created the blog, available at http://engproducaoufersa.blogspot.com, as seen in Fig. 4.

Some effort and care was observed in the creation of this blog. The students created many tabs to each industrial engineering area and did interviews with engineers. The most important contribution of this group was the creation of a mind map (it can be observed in the site), which connects all industrial engineering areas so one can understand the importance of them all.

The greatest benefit to students in creating the mind map was in gaining a holistic understanding of an industrial engineer's function in industry. This systemic view is very important for students because they understand the components' interconnections in the course curriculum. The students could see the importance of the interaction among disciplines to generate solutions for the industry. This exercise allows them to understand that knowledge is constructed by the connections that they make between the contents of each discipline of the industrial engineering course.

It is important to highlight, however, that before the professor proposed the activity, he had presented examples of problems whose solutions were a mix of different tools from distinct disciplines. One example presented was a solution to a problem in which a great deal of knowledge was involved: sustainability, engineering economics, operations research and operations management—four Industrial Engineer areas [26].

According to the example presented by the professor, the students must find other applications and structure the material for the blog, in order to answer three questions:

1. What is the problem at the organization?
2. According to the area you are studying, which tools did it use to solve the problem?
3. Characterize the result obtained by the tools applications.

These three questions must be answered about four different problems, guiding the students to organize their ideas. The second activity is the interviews that each group must conduct. The script for the interview was the responsibility of each group and the professor gave suggestions to improve the data collected by students. It was observed that interviews were performed with CEOs, professors of different institutions and engineers who work in other cities. We could confirm the effort made in the development of this work by the diversity of

**Table 5.** Students' perception about the developed activity

| Positive aspects | Negative aspects |
|---|---|
| *The students' effort to obtain information that will be useful to professional life*. (Student 7) | *I learn much about my theme. However, I could learn more about the other themes if the professor expose them . . .* (Student 9) |
| *It gets out the methodology of exposition of contents . . .* (Student 13) | *Less experience in this kind of work*. (Student 10) |
| *The professor stimulated the students to reach knowledge beyond the classroom . . .* (Student 20) | *I had difficulty to obtain the interviews . . .* (Student 22) |

content produced by the students. All these activities were underlined with the potential of the blog as an educational tool, according to [16]. At this point, the professor noted that this kind of activity gives better learning results compared with presentation of the contents by the professors.

By analyzing the developed blog, it can be observed that it works as a pedagogical strategy, by assuming the role of a digital portfolio with the contribution of each group. The blog integrates the students' different ideas and it is available on the network. It characterizes the pedagogical use of a blog [21].

The material developed by the students was prepared based on different media (videos, texts, audio, and other resources) and made available on the blog by link indications. This allowed the blog reader to trace his/her own reading path, based on their choice of link. This illustrates the form of the blog use proposed by [22].

A sense of contributing and information sharing beyond the classroom was created in the student. The blog is being published for clarity for BC&T students who did not choose an engineering course. This form of exposure of the blog created a sense of responsibility [2] because the prepared material is available on the network and is used as a reference for BC&T students.

After the development of the blog, the last step of this research is to evaluate the efficiency of the activity proposed by the professor. First, it identified the students' motivation to do the proposed work (94% of the students feel motivated by the work proposed).

It was also identified if the students had changed their point of view about the function of industrial engineers (94% of the students said they had changed the way they see an Industrial Engineer's work). The students perceived their change in point of view regarding an industrial engineer's function. We can identify the element of value in the activity [12].

Most students (87.8%) considered that the methodology of collaborative learning developed by the professor is better than the exposition of concepts. However, some points are considered problematic in this methodology and they are shown in Table 5.

It can be concluded by the statements of the students that the activity allowed the development of an element of autonomy [12]. It can be observed that the students had done a great deal of research. Regarding this, the activity proposed allows students to improve their work using their imagination and organizing their ideas better.

The activity developed using the blog stimulated interaction among students and they considered that the interchange of information was facilitated by the use of the blog tool (Fig. 5). The students see the blog as a tool to stimulate interaction among the groups, as illustrated in Fig. 6. This fact was observed by the professor of the discipline when students were presenting their work. During the presentations, the students contributed to other

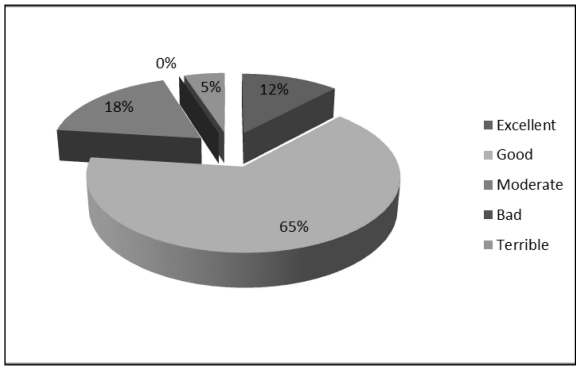


**Fig. 5**. How do you classify the interchange of information among the students?

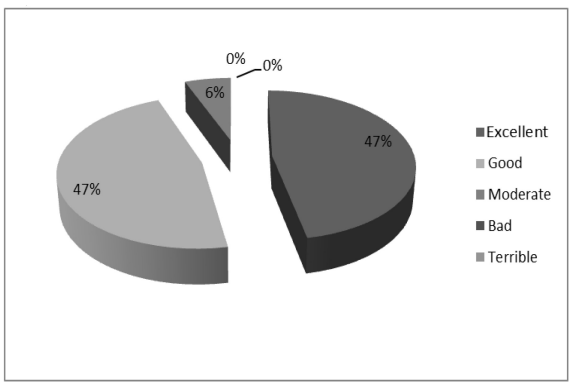


**Fig. 6.** How do you see the idea of using the blog to stimulate the collaboration among the groups?

**Table 6.** Statements about students' diligence in preparing the material published on the blog

| |
|---|
| *The blog will be available to other students who want to make the industrial engineering course . . .* (Student 15) |
| *. . . we have done much research, studied hard the contents and solved our doubts in the performed interview . . .* (Student 17) |
| *. . . we did research . . .* (Student 21) |

works and they contextualize with their experiences during the development of the work.

The students (82%) considered the activity proposed by the professor to be good or excellent. This fact confirms the value element. The students (70%) had great interest in reading the other groups' work.

The three elements proposed by [12] are added to the development of the activity, and the blog allows a motivational environment to be created. The students developed their work without worrying about the evaluation, but they worried about the learning process.

The students (81%) considered that care was taken about the material prepared to be posted in the blog. This care confirms another positive point defined by [2]: the students' conscientiousness and responsibility about the material posted on the blog. The most significant students' statements are presented in Table 6.

The proposed activity allowed better learning, compared with traditional classes. The students were encouraged to make their contribution available and spread the results found.

A proactive attitude in the students could be observed and the work stimulated their investigative spirit. They felt very motivated towards understanding the function of an industrial engineer, as was confirmed by the large amount of information collected. The collaborative construction of the blog was positive and the data collected will be used by the industrial engineer course to present the course to other students.

Finally, the idea of creating a blog established a collaborative environment and the students posted their experiences and complemented the other groups' postings. The final version of the blog was created by the students with a responsible approach.

## 6. Conclusions

The development of this research allows the demystification of some points in engineering education. The collaborative strategy stimulates a motivational environment. The proposed activity increases the students' motivation to understand the function of an industrial engineer and this allows the students to put more importance on the subjects presented in classes.

This does not mean doing without classes, but it shows that both strategies can be used together to maximize the learning process.

The methodology developed in this research allows the professor to develop the students' curiosity and promote a proactive attitude. This created a self-motivational environment and facilitated the learning process. This environment promoted the interaction and the participation of all students, who were able to interact with the other groups and with engineers outside of the university.

The blog was diligently created and it is being used to expose the "Industrial Engineering area" to BC&T students who did not choose the engineering course. Another benefit of this experiment was the availability of the knowledge constructed by students outside the university and the blog proved to be very positively received for this purpose.

This pedagogical strategy application has great potential for use in other engineering courses. This strategy, however, is difficult to apply for the need to form professors in these technological tools and they must change their attitude in the classroom.

There hypothesis in this research is not confirmed: even if the students know the importance of each discipline to the industrial engineer, it is not possible to state that it will improve their study. It is necessary to perform more research in the future to evaluate the effects of this strategy. The next step can be to measure the students' performance in the disciplines after they have taken part in this activity.

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