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# FORESIGHT SCENARIOS AND INFLUENCING FACTORS IN A SMART CLASSROOM IMPLEMENTATION

# CENÁRIOS DE PREVISÃO E FATORES DE INFLUÊNCIA NA IMPLEMENTAÇÃO DE UMA SMART CLASSROOM

# ESCENARIOS DE PREVISIÓN Y FACTORES QUE INFLUYEN EN LA IMPLEMENTACIÓN DEL AULA INTELIGENTE

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## ABSTRACT

Education 4.0 is located as a conceptual-technological construction that aims to provide background knowledge and tools for the authorship of management trajectories and initial and continuing vocational training. In the educational scenario the concept of intelligent classroom has the focus in the process of teaching and learning, aiming to make it adaptive and centered in the user. Thus, we can highlight as the main objective of the project the creation of a smart classroom in the 4.0 education model. And as specific objectives the creation of a reference catalog of 4.0 education methodologies that fits the needs of IFMA and the training of IFMA teachers in these proposed methodologies. The construction of scenarios deals, normally, with highly complex systems - non-linear systems - and dynamic, that live with continuous structural changes and with a high degree of uncertainty about the paths of these changes.

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Keywords: Smart Classroom; Scenarios; Foresight.

## RESUMO

A Educação 4.0 situa-se como uma construção conceitual-tecnológica que visa fornecer conhecimentos e ferramentas para a autoria de trajetórias de gestão e formação profissional inicial e continuada. No cenário educacional o conceito de sala de aula inteligente tem o foco no processo de ensino e aprendizagem, visando torná-lo adaptativo e centrado no usuário. Assim, podemos destacar como principal objetivo do projeto a criação de uma sala de aula inteligente no modelo educacional 4.0. E como objetivos específicos a criação de um catálogo de referência de metodologias de ensino 4.0 que se adequem às necessidades do IFMA e a formação de professores do IFMA nestas metodologias propostas. A construção de cenários lida, normalmente, com sistemas altamente complexos - sistemas não lineares - e dinâmicos, que convivem com mudanças estruturais contínuas e com alto grau de incerteza sobre os caminhos dessas mudanças.

Palavras-chave: Sala de Aula Inteligente; Cenários; Previsão.

## RESUMEN

La educación 4.0 se ubica como una construcción conceptual-tecnológica que pretende brindar conocimientos de base y herramientas para la autoría de trayectorias de gestión y formación profesional inicial y continua. En el escenario educativo el concepto de aula inteligente tiene el foco en el proceso de enseñanza y aprendizaje, con el objetivo de hacerlo adaptativo y centrado en el usuario. Así, podemos destacar como objetivo principal del proyecto la creación de un aula inteligente en el modelo educativo 4.0. Y como objetivos específicos la creación de un catálogo de referencia de metodologías de educación 4.0 que se ajuste a las necesidades de IFMA y la formación del profesorado de IFMA en estas metodologías propuestas. La construcción de escenarios trata, normalmente, de sistemas altamente complejos -sistemas no lineales- y

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dinámicos, que viven con continuos cambios estructurales y con un alto grado de incertidumbre sobre las trayectorias de estos cambios.

Palabras clave: Aula Inteligente; escenarios; Previsión.

## 1 INTRODUCTION

Education 4.0 is located as a conceptual-technological construction that aims to provide background knowledge and tools for the authorship of management trajectories and initial and continuing vocational training. Evidences pointed out in researches have shown the applicability of this approach and open perspectives for the contribution of new studies that can improve both the fundamentals and the practices of an advanced education (CARVALHO NETO, 2017).

A good starting point is the creation of innovative environments conducive to the development of projects that bring students closer to this new reality. Spaces where students learn by doing and testing infinite possibilities. For this, there is the possibility of creating smart rooms. They comprise the junction of classroom, laboratories, computer room and library at the same time and in the same physical space. In this intelligent room the design is digital and analog media, using the teaching-learning model focused on courses by projects, with digital environments aimed at education and finally experimental laboratories with remote management by Internet.

The main objective of the project is to design, design and build an intelligent classroom that meets the needs of the Federal Institute of Maranhão (IFMA) and at the same time is in accordance with the best practices already applied in institutions that already use this model. This intelligent classroom should be presented as a pilot project, which can be expanded to all Institute campuses. For this a campus will be chosen to host the project. From it, with the room built, it will be possible to train teachers to use it, as well as evaluate if the teaching-learning practices and the use of the equipment are as expected.

In the educational scenario the concept of intelligent classroom has the focus in the process of teaching and learning, aiming to make it adaptive and centered in the user (FISCHER et al., 2018). Thus, we can highlight as the main

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objective of the project the creation of the smart classroom in the 4.0 education model. And as specific objectives the creation of a reference catalog of 4.0 education methodologies that fits the needs of IFMA and the training of IFMA teachers in these proposed methodologies.

## 2 INFLUENCING FACTORS

In the design of the smart classroom, it is possible to identify some influencing factors for the implementation and for the subsequent maintenance, either of the physical space of the room, or for the application and use of new methodologies within the IFMA. Among the various factors, the ten most important are mentioned in this work.

**Resistance to new methodologies:** The main difficulty in implementing new methodologies is to engage teachers in a model that differs from traditional teaching. This is because those involved are removed from their comfort zone, whether they are teachers or students. Educators become more questioned by students, as they become mediators and not instructors. Resistance arises, because many were used to exposing the content and not being an adjunct to the classroom. This change and adaptation is extremely difficult for many teachers.

**Lack of physical space for the smart classroom:** Far beyond simply adopting cutting-edge technologies, educational institutions become a reference in making methodological and physical changes. An innovative “ecosystem” needs to involve three factors: equipment, spaces and people. A smart classroom starts with physical space. These rooms need to allow for various types of composition. The work is not always in groups, nor is the class always expository. Within IFMA there is a constant dispute for physical spaces. Whether to serve a department or to serve some sector of the community. Therefore, achieving a dynamic space where the room can be implanted is a key influencing factor in the project.

**Political disinterest:** Despite being an educational institution, IFMA is today a primarily political environment. This configuration permeates interests in management positions and political positions in the country's spheres of power. Deploying the smart classroom at IFMA can at the same time serve the

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political interests of a particular group as opposed to the interests of another group. This tends to hinder the implementation process if the opposite group is in charge. However, the same process tends to be facilitated, if the favorable group is ahead. For this aspect, it is important to highlight the importance of the project to whoever is in charge of the institution.

**Student demand for innovative classes:** By definition, innovation is the process that seeks to make our lives better. It creates resources that affect us in the most diverse aspects, changing the way we communicate, learn and think. This consequently changes our view of the world. Many schools believe that just bringing computers and other electronic devices into the classroom is already a good size for innovation. However, far beyond simply including technology in the students' daily lives, it is necessary to innovate in the pedagogical resources, in order to take, in fact, a step forward in the education of the students.

**Limited resources for deployment:** The cost of implementing the smart classroom is estimated between R$ 60,000.00 (sixty thousand reais) to R$ 100,000.00 (one hundred thousand reais). They refer to the implementation of the project's pilot room. Each replicated room is estimated to cost approximately the same amount. The dissertation and methodological models do not have a fixed price, as they are aligned with IFMA's strategic planning and are not about equipment acquisition. However, IFMA does not have these resources quickly. In addition, the federal government has programmatically reduced and limited education resources.

**Industry 4.0 growth:** The fourth industrial revolution, commonly known as Industry 4.0, is a term that sums up technological advances in industrial processes. In this scenario of change and totally new for the vast majority of companies, the adoption of this concept is a determining factor for the growth of the productive chain in Brazil. However, manpower is lacking to meet the demands of this type of industry. In Brazil, the vast majority of professional education institutions, such as IFMA, are not preparing their students for this reality.

**Number of campuses at IFMA:** From this pilot-based Smart Classroom, it is expected that all other campuses will in the future take ownership of this model and deploy their own Smart Classrooms. The IFMA

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has more than 30 campuses in the state. With this in mind, the proposal is that to reach the maximum number of students and employees the final cost of deployment is the lowest possible.As it is a state with territorial dimensions similar to a medium-sized European country, Maranhão has access problems for the various campuses spread across the state. Navigating the campuses to carry out deployments and training becomes a challenge in the same proportion of the territorial dimensions.

**Use of new technologies in the classroom:** The world is undergoing a major digital transformation, with the ever stronger presence of new technologies at all times in our life. Education needs to go hand in hand with this transformation, adhering to these technologies and implementing them within the classroom, in order to make student learning more interesting and dynamic. It is also up to educators to encourage the use and bring these new technologies to their classes, as they have the power to cause a change in the school environment. Students have become more active people, due to the large amount of information they receive daily. The technologies will have the function of sharpening the perception of these students and the learning can move towards an improvement in the interpretation of what is taught.

**Sudden changes in campus or institute management:** Like political disinterest, the sudden changes in the institute's management can directly impact the project, both in the short and long term. The federal government has been averse to the elections that take place to elect the rectors of the institutes, appointing in other institutes across the country people who did not even run for internal elections. Adding this to the continued budget cuts and limitations, there is a tendency for a new management to cancel everything that the current management is creating and that impacts the institute.

**Support from technology teachers:** Having the support of teachers and other collaborators in the process of adopting technology at school is fundamental, after all, they are the ones who will deal directly with the issue, so the more in favor of change, the better. In addition to motivating the use of technology among these professionals, offering training, computer classes and even auxiliary employees to make them more secure with the use of new resources. Monitoring the relationship of each one with the technologies

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adopted in order to diagnose problems, receive feedbacks and promote constant improvement is also essential. Technology teachers are adept at these practices and tend to support this type of change. Having this support can be fundamental to the project.

## 3 SCENARIOS

The future has been, over time, a recurring concern of human beings, even when the conviction that destiny would be only a decision of the gods or nature, or even when the life cycle seemed to present a great regularity prevailed. For Bernstein (1997), until human beings discover the risk "... the future was a mirror of the past or the obscure domain of oracles and diviners that held a monopoly on the knowledge of predicted events". According to this author, until the Renaissance, the future was associated with luck and destiny, over which humanity had little or no control. Under these conditions, personal choices were dominated by passivity or guided by instinct. But even so, men always sought to interpret and interrogate the future, using different magical and mystical means.

The construction of scenarios deals, normally, with highly complex systems - non-linear systems - and dynamic, that live with continuous structural changes and with a high degree of uncertainty about the paths of these changes. Typically, these scenarios must deal with realities in which the results of a original change are not proportional to the causes, also multiple and diverse. Complex systems are characterized by feedback processes that establish conditions for self-organization and change. As Capra (1996) indicates, "... non-linear feedback processes form the basis of instabilities and the sudden emergence of new forms of order, so typical of self-organization". In any complex and non-linear system, there would be two different regulatory mechanisms: positive feedback, which creates a dynamic of self-reinforcement of disorganization processes causing a chain reaction; and the negative feedback, which, in turn, consists of mechanisms of self-regulation, which are opposed to the process of disorganization and rebalance the system.

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### 3.1 Scenarios in Foresight Management

According to Godet (1985), scenarios are configurations of images of the future conditioned and based on coherent games of hypotheses about the probable behaviors of the determining variables of the planning object. Michael Porter (1989) defines scenarios in a similar way, that is, as an "internally consistent view of future reality, based on a set of plausible assumptions about the important uncertainties that may influence the object". Similar is the understanding of Van Der Heijden (1996), for whom scenarios constitute a set of reasonably plausible but structurally different futures, conceived through a process of reflection that is more causal than probabilistic, used as a means for reflection and the formulation of strategies for act on the futures models. The scenarios, therefore, deal with the description of a future - possible, imaginable or desirable - for a system and its context, as well as the path or trajectory that connects it with the initial situation of the object of study, such as stories about how the world (or a part of it) may move and behave in the future. To the extent that it must deal with complex and non-linear systems and contemplate the uncertainty of future events, the construction of scenarios must deal with a reasonable degree of weightlessness. From this point of view, it does not constitute a scientific activity adequate and able to explain the past, but is limited to anticipating futures. Although there are several methodologies and technical guidelines for the construction of scenarios, in general, all paths follow a logical sequence (for both the inductive and the deductive method) of similar methodological steps, ranging from the identification of latencies (events and processes to the definition and combination of plausible assumptions about the future of uncertainties.

The working process of these methodologies normally seeks to respond to a set of five fundamental questions: 1. What factors (conditioning factors) are maturing in the current reality that indicate a future trend? 2. What are the most relevant constraints and those with the most uncertain future performance (main uncertainties)? 3. What hypotheses seem plausible for the definition of possible and probable future behaviors of these central uncertainties? 4. How can the different hypotheses be combined for the various uncertainties considered

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relevant? 5. What combinations of hypotheses of uncertainties can be considered consistent for the formation of a coherent set of hypotheses?

## 4 SMART CLASSROOM SCENARIOS

Four scenarios are proposed for the smart classroom project. They focus on what classrooms and teaching methodologies will look like in 2040. Classrooms focus on an axis ranging from physical rooms to virtual rooms. And the teaching methodologies focus on an axis that goes from dominating traditional methodologies to dominating active methodologies. They are represented in Figure 1 within the axes of scenarios using playful representations of what these scenarios might be.

**Figure 1: Scenarios Axis for Room Types x Methodologies**


Source: Developed by the author.

With that we have the scenarios: 1. Springfield School (where traditional methodologies continue to be used in purely physical environments); 2. Jetsons Class (where purely virtual classrooms are managed by artificial intelligence that act just like traditional teachers); 3. Pokémon Professor (where students are left free in non-physical environments and learn actively); 4. School of Rock (where in physical environments students learn actively with a teacher as a mediator).

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These scenarios are covered in detail below. For that, stories are used, SWOT method, strategic options to deal with the situations that occur in these scenarios and a way to deal with the problems encountered in daily life.

### 4.1 Scenario 1 - Springfield School

As in the upper left quadrant of Figure 1 shows, scenario 1 is built by the existence of physical rooms and traditional teaching methodologies. In this scenario, we can observe students lined up in a classroom where the teacher is the focus of the activity. The teacher has all the knowledge, and the students are merely content reproducers.

For the operation of a class in this scenario, only the teacher can speak. Students need to remain silent, always watching the board and the teacher, and they will only be able to do something if requested. This scenario currently exists in a comprehensive way, as it has existed for over a hundred years. So it is a totally realistic scenario of what we can still have in twenty years. As possible stories and paths for this scenario we have: Students spend most of the class bored and most of the time without understanding what the teacher is talking about; Homework activities are undervalued if they behave only as reading and memorizing content that for the most part will not be used in the student's daily life; The teacher has a stressful routine because he needs to stand for more than eight hours a day and talk constantly. Many end up getting sick because of work activity. Spine and throat diseases are the most common.; The classrooms are overcrowded, with more than 40 students. These students are distributed in the classroom without taking into account the wishes of each one. Naturally, those in the front rows will be able to see, hear and interact better with the teacher. Those in the back rows will not be able to perform as well; The furniture follows the same pattern used in the 1940s. Walls with a board where the teacher notes the content to be copied. A large teacher's desk that identifies the hierarchy in which he is placed. Small tables and chairs for students to place themselves in a smaller hierarchy. Murals and maps with information and warnings. Generic color palettes and tending to brown, beige and neutral colors; Schools are still designed similarly to penitentiaries. Where the rooms resemble cells, there are corridors where students cannot transit outside of defined hours.

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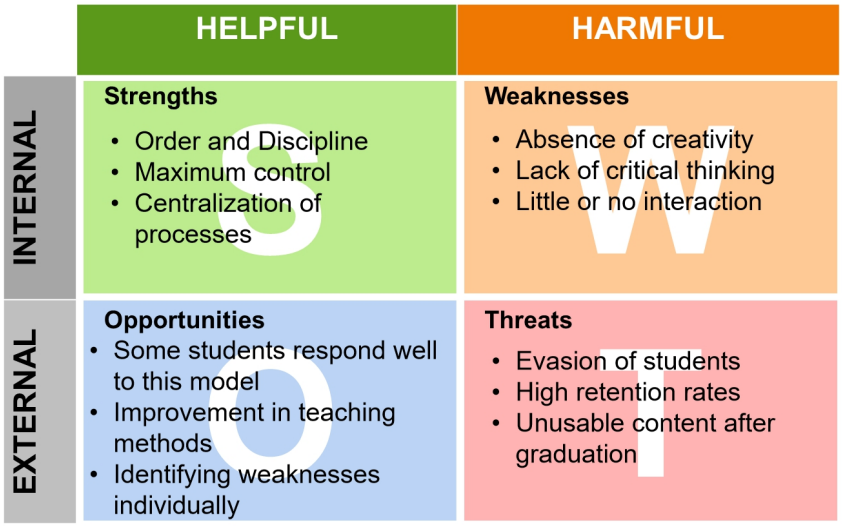
There is an interval between blocks of classes in which students can eat and perform other activities.

With that, we can see the impact that scenario 1 can have on IFMA. The SWOT matrix shown in Figure 2 shows that although old and outdated, this model that has lasted for more than a hundred years and that will tend to continue to exist, has beneficial characteristics that can be used. And that we must take extra care with their weaknesses and threats. As forces we can observe the order and discipline that is applied to students and the institution. The maximum control of everything that happens in the classroom by the teacher and the school management and the centralization of the teaching-learning process in the teacher, which can allow that he conducts the class in the best way, including seeking new methodologies. As weaknesses, it is possible to highlight the lack of creativity on the part of the students, as they are not led to have critical thinking.

**Figure 2: SWOT Matrix for Scenario 1**




Source: Developed by the author.

The lack of student-student or student-teacher interaction is also something to be considered. The clearest threats in this scenario are the evasion and retention of students. Since they tend to dislike or feel motivated in a class in this scenario. The lack of use of content absorbed in the classroom in the real world also helps in this factor. Therefore, there are opportunities for improvement within this scenario. Some students, although few, respond well

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to this type of education. It is also possible to improve the teaching methods used by teachers and to individually identify students' deficiencies and weaknesses, thus enabling other approaches for identified students.

### 4.2 Scenario 2 - Jetsons Class

As Figure 1 in the upper right quadrant shows, scenario 2 is built by the absence of a physical classroom, in this scenario the classroom can be anywhere, and by the use of traditional teaching methodologies, despite the high technology available in this scenario. It is possible to observe that technology is something inherent in the daily lives of these students.

Real teachers do not exist and all teaching activity was in charge of Artificial Intelligence (AI) highly specialized in the content they teach. Each of these AI is able to teach only their discipline and they do it in the same way that human teachers did in 2020. Students are mere spectators of technology and have no space to think beyond what is shown to them. In contrast, AI are able to understand students' problems more effectively and individually and work in an adaptive manner to improve learning performance.

As possible stories and paths for this scenario we have: Students study at home, on the street, in the park, anywhere is a possible classroom; The teacher is an AI that accompanies the student twenty-four hours a day applying the content and evaluations; Wearable devices, monitors, computers and mobile devices allow AI to accompany the student; Critical thinking is not encouraged as all available human knowledge is on the internet for duplication; There is no interaction with other students. Each student is at a different level of knowledge, so the exchange of information between them is not encouraged, despite existing on unofficial communication channels. This unofficial communication ends up enabling students who do not want or cannot learn to solve the evaluations using answers acquired by students who understand the discipline; Parents receive a daily report of activities performed by students. This report contains, in addition to the contents taught by the AI, the student's performance, the student's study locations and times. Due to the large amount of data received, parents are often unable to read the entire report. For that there is another AI responsible for this.

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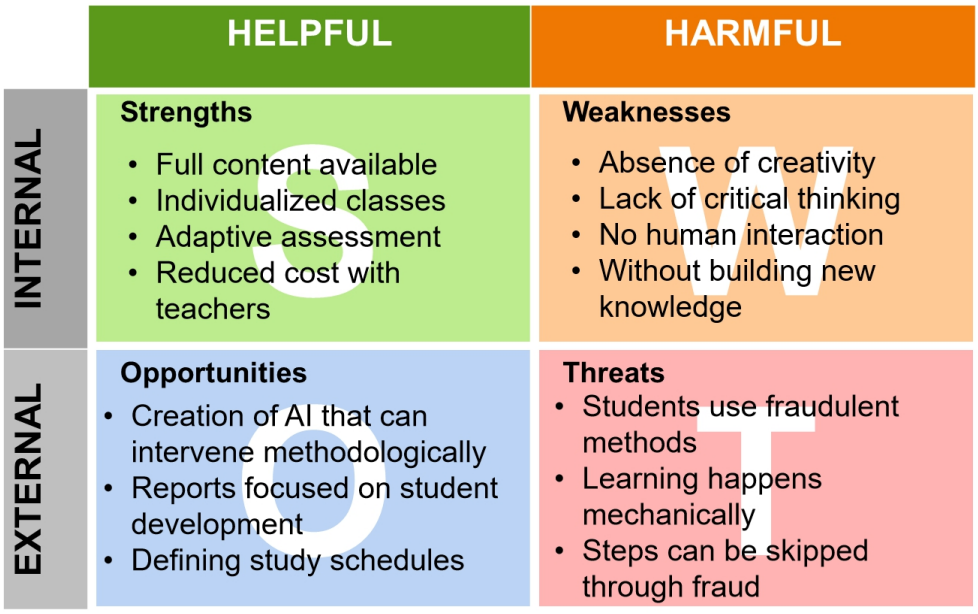
**Figure 3: SWOT Matrix for Scenario 2**




Source: Developed by the author.

Scenario 2 has the power to reduce IFMA's physical and academic structure, nullifying the design of the smart classroom. The SWOT matrix presented in Figure 3 shows that.

Although it looks like a very good scenario, it perpetuates old teaching practices despite all the technology involved. Even though students have access to all available content through the mediation of an expert AI, the lack of creativity and critical thinking can lead to an excessive use of fraud by students both to pass the assessments and to indicate that a particular class has been completed. Therefore, the opportunities we have for improvement are situations that can at some point be implemented at IFMA.

### 4.3 Scenario 3 - Pokémon Professor

In the lower right quadrant of Figure 1 presents a scenario 3 where the total absence of physical space for the classroom is prevalent in parallel with the use of methodologies totally different from a conventional model.

The name Pokémon Professor is due to the reason that in the history of the cartoon, a child when turning ten years of age, receives from the Professor, a pokémon and a pokédex to start trips around the world to learn about life and

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pokémon. This parallel is due to the fact that in this scenario students would receive a monitoring system, which they could use as a support for doubts and knowledge generation, while they should go out to live the world, learning professions, tasks and content according to your aspirations. The Professor in this scenario works as a figure of mere support, which can be consulted whenever the support system is not sufficient. As possible stories and paths for this scenario we have: Students spend most of the day involved in educational activities without realizing that they are learning. For them these activities are everyday activities; Teachers act as support managers, tutors who indicate to the support system the databases to be used and indicate to students what they need to do when they have any questions; The family does not participate in the support network, however it participates in an active part of the educational process, since part of the student's life is spent in activities together with the family; Cities are safe and adapted so that students can freely and effectively move between neighborhoods, cities and even countries if necessary; The entire population participates in some way in the teaching-learning process. It is a collective conscience that it is important for everyone that students prepare for the world, so the world must help these students to prepare; There is no fixed content of subjects, everything is volatile and everything adapts to the student's needs and wants. He is able to learn physics, chemistry and art in the same life experience and yet without having to name the subjects.

Scenario 3 is able to contemplate the fullness of an active methodology, where the student is actively the builder of knowledge. If applied to IFMA, what we would have would be, similar to scenario 2, an almost complete reduction of the physical and academic structure, canceling the design of the intelligent classroom. The SWOT matrix shown in Figure 4 shows that despite complex threats or needing a high-level abstraction, this scenario would be a solution to many of the educational problems we are experiencing today.

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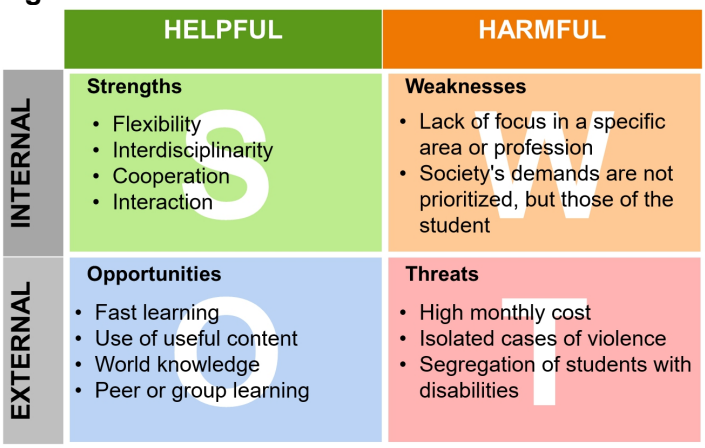
**Figure 4: SWOT Matrix for Scenario 3**




Source: Developed by the author.

This scenario has as its main strengths flexibility, interdisciplinarity, cooperation and interaction between the student and the world. The main opportunities are fast learning, use of useful content, world knowledge and peer or group learning. As a weakness it is possible to verify a lack of focus in a specific area or profession and that society's demands are not assigned, but those of the student. The main threats are the high monthly cost, isolated cases of violence and the segregation of students with disabilities.

### 4.4 Scenario 4 - School of Rock

Scenario 4 is shown in lower left quadrant in Figure 1, it is positioned within the quadrant identified by the axes of the physical classroom and the use of active methodologies. It consists of a room with innovative elements that enable students to have constructive experiences in the teaching-learning process. This classroom model is what we are currently looking to build at IFMA with the smart classroom. This scenario was named after what happens in the film School of Rock. Where the teacher encourages students to be active agents in their own learning and helps them to identify their talents and aspirations.

As possible stories and paths for this scenario we have: Students are active agents in the teaching-learning process. They build their own knowledge based on what the teacher indicates and helps; Teachers are no longer the holders of knowledge and start to behave as tutors and mediators of content for students; The classroom becomes a playful environment with a pleasant color

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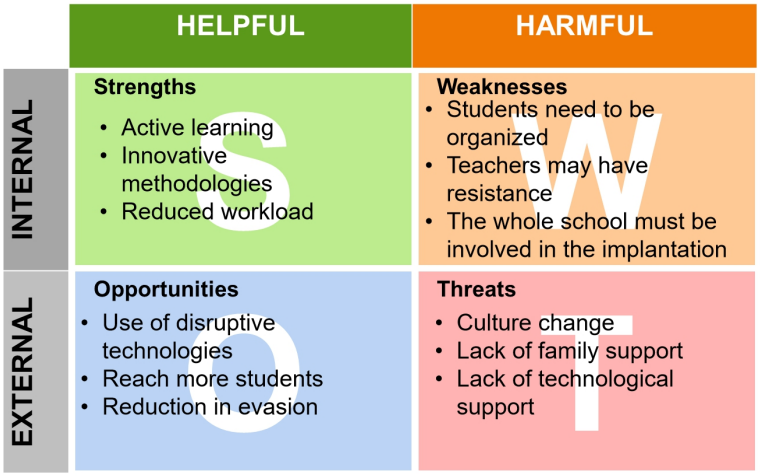
palette and tools and objects aimed at building active knowledge; The disciplines start to be elaborated aiming the application in the world and their subjects are approached through questions and problems; There is great resistance from teachers involved with traditional methodologies. These teachers avoid at all costs applying the active methodologies to the students, causing in these subjects a rate of dropout and retention well above the average; The hours of classes are drastically reduced, because now the repetitive content must be studied by the student at home. The school serves mainly for the teacher to work with students on their main difficulties.

The SWOT matrix shown in Figure 5 shows that, the main forces can be shaken if any of the threats materialize. In the same way that the main weaknesses open up a range of latent opportunities.

**Figure 5: SWOT Matrix for Scenario 4**




Source: Developed by the author.

## 4.5 Strategic options

As options for strategies to be applied in the four scenarios, as shown in Table 1, taking into account what can be done to improve the potentialities found, mitigate weaknesses and avoid threats as much as possible, twenty general strategies were defined.

Each of them was analyzed within a scale ranging from -2, -1, 0, 1 and 2. On this scale -2 means no impact or importance and 2 means a lot of impact or importance. These weights are later added and scaled as the most robust

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strategies for the future. That is, which of these strategies serves all scenarios with the greatest impact. After that, the main strategies for each scenario were defined. Diversification of teaching methodologies and Family and school integration were defined.

**Table 1: Strategic Options with Robust and Focused Strategy**

| Strategic Options | Springfield School<br>Scenario 1 | Jetsons Class<br>Scenario 2 | Pokémon Professor<br>Scenario 3 | School of Rock<br>Scenario 4 | Future Robust Strategy (∑) |
|---|---|---|---|---|---|
| Employee training | 2 | -2 | -1 | 2 | 1 |
| Technology investment | 1 | 2 | 1 | -1 | 3 |
| Diversification of teaching methodologies | 2 | 2 | 2 | 0 | 6 |
| Research investment | -2 | 2 | 1 | -1 | 0 |
| Increase in teacher's salary | 1 | -2 | 0 | 2 | 1 |
| Family and school integration | 1 | 2 | 1 | 2 | 6 |
| Expand business participation | 0 | 1 | 1 | 2 | 4 |
| Reduction of workload in the classroom | 1 | -2 | -2 | 1 | -2 |
| Improved student-teacher communication | 2 | 2 | 2 | -2 | 4 |
| Run Problem-Based Learning Scenarios | 2 | 1 | -2 | -2 | -1 |
| Establish Cooperative Base Groups | 1 | -2 | -2 | 1 | -2 |
| Experiment with Peer Teaching | 1 | 1 | 0 | 2 | 4 |
| Encourage Students to Propose Ideas for Projects | 1 | 2 | 0 | 2 | 5 |
| Integrate Relevant Word Problems | 2 | 2 | -1 | 1 | 4 |
| Offer Different Types of Free Study Time | 1 | 2 | -1 | 1 | 3 |
| Use Media that Positively Depict a Range of Cultures | 2 | 2 | 1 | 0 | 5 |
| Call on Each Student | 1 | -2 | -2 | 2 | -1 |
| Gamify Lessons | 2 | 2 | -1 | 2 | 5 |
| Deliver Different Forms of Content through Learning Stations | 2 | 2 | 2 | -1 | 5 |
| Present New Concepts by Using Student Vocabulary | 1 | 1 | 1 | 2 | 5 |
| **Focused Strategy** | Diversification of teaching methodologies | Diversification of teaching methodologies | Diversification of teaching methodologies | Family and school integration | |

Source: Developed by the author.

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## 5 CONCLUSION

With the assessment of the scenarios and their strategies, it is possible to bring into the IFMA's daily routine and the implementation of the smart classroom project some factors. Today we basically live in scenario 1, with the implementation of the project we should gradually migrate to scenario 4. However, understanding scenarios 2 and 3 allows us to see possibilities that had not been noticed before.

Building a model of methodologies to be applied to IFMA goes far beyond the construction of a physical space. Enabling students to experience the classroom outside the physical environment can broaden the horizons of the teaching-learning process.

The next steps to be developed are to use the bases developed in these scenarios to make decisions that directly affect the project's implementation and maintenance process. Identify additional ways to apply the new methodologies to students and teachers without necessarily using an intelligent classroom.

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