HOW TO DEPLOY A SERIOUS GAME IN THE ACADEMIC WORLD? APPLICATION TO "LINO HAS AN IDEA"

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ABSTRACT

Serious games are not only designed for entertainment but also to convey an educational message. From childhood to the professional world, this new form of educational gaming is popular but insufficiently developed for children. Previous research indicates a particular gap in innovation within this landscape of educational games. In response to this issue, the game "Lino has an Idea" was created and experimented with in several classrooms, in both physical and digital forms. However, this game exists in only one copy and needs to be disseminated. In this article, the first step is to highlight a deployment method for a serious game in the educational world by understanding the various stages that compose it. Once established, it aims to apply this method to the case of the serious game "Lino has an idea" in France. The focus of this article is centred on the dissemination of a serious game.

Keywords: Serious game, school, resources, dissemination, innovation

1 INTRODUCTION

The shift towards innovative and engaging teaching methods is crucial in today's educational landscape, with serious games emerging as a pertinent solution. The serious games market is projected to grow significantly from USD 12.74 billion in 2023, with a CAGR of 28.99% during the forecast period (2023-2028). This growth highlights the increasing relevance of serious games in educational and professional settings, supported by widespread adoption across global markets [1].

Serious games like "Lino has an idea" offer a promising solution to enhance learning and skill development among students aged 6 to 9 (cycle 2) and 9 to 11 (cycle 3) in France [2], [3], [4]. However, developers often face challenges in determining the optimal deployment method within the educational system [5]. This article addresses these challenges, focusing on the deployment strategy for "Lino has an idea."

The article first explores the general strategy for integrating serious games into educational programs, emphasizing communication, program integration, and the necessary resources and budgets for successful implementation. It then uses the case study of "Lino has an idea" to examine the key steps in deploying this game in France.

Through this comprehensive analysis, the article aims to provide insights into how serious games can effectively be adopted in schools, thereby promoting interactive education tailored to the specific needs of students.

2 STATE OF THE ART

A fundamental aspect of serious games lies in their ability to transform the act of learning into an immersive and engaging experience. Rather than adopting a traditional didactic approach, these games integrate playful elements to foster active learner engagement. This approach, combined with interactive scenarios and contextualized challenges, aims to enhance the understanding of concepts while stimulating the development of practical skills. Educational serious games have evolved in response to the growing demand for interactive learning tools.

Active learner engagement enhances understanding and knowledge retention, contrasting with traditional lecturing and passive learning. Classroom discussions, collaborative projects, and interactive tools have become vital for modern education, prompting the adoption of serious games and educational technologies. This shift aims to create dynamic, stimulating learning environments aligned with 21st-

century educational goals. Educators must ensure new resources meet standards and pedagogical objectives, choosing reliable tools that complement existing curricula. "Lino has an Idea" has been optimized in a previous study [7], focusing on its professionalization.

Serious games are widely used in professional training across various fields such as medicine, industry, and universities, enabling learners to practice in realistic scenarios. However, their adoption in primary and secondary schools remains relatively low despite efforts to increase their visibility [8]. "Lino has an Idea" fills this gap by offering an innovative educational experience for children aged 7 to 11, successfully tested in classrooms with positive results in student engagement and fostering innovative thinking [9]. Yet, questions persist about how teachers find and adopt new educational materials and the best strategies for disseminating serious games in education.

The upcoming study aims to explore these mechanisms, using "Lino has an idea" as a specific case, to adapt the game based on identified needs and contribute to the literature on the effective dissemination of innovative educational serious games for children. Thus, following other articles using the application of this game to address serious games-related topics, we will first develop a general dissemination method within the education system.

3 PROPOSITION OF A METHODOLOGY TO DIFFUSE A SERIOUS GAME

The proposal of a dissemination methodology for a serious game starts from its creation to its distribution. It begins firstly with a market study, its development, its potential for use in educational programs.
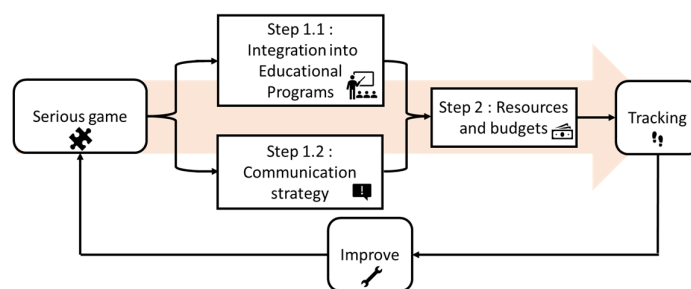

Figure 1. Schematic representation of the methodology for disseminating a serious game

Figure 1 represents the methodology for disseminating a serious game in the educational environment, which will be explained in the following points. Starting with the game's functionality, the first step is to integrate it into educational programs and establish a communication strategy. Next, a financial analysis examines available resources. Monitoring and iterative improvements ensure the game's sustainable longevity.

In this section, we will detail what each of these points entails.

3.1 Integration into Educational Programs

Serious games align with educational standards, enhancing credibility and relevance. Adapting to these standards ensures a consistent learning experience that contributes to educational objectives. Incorporating serious games into national educational programs is crucial for maximizing their impact [7], [8], involving adaptation and pedagogical justification. Successfully integrating these games validates students' skills, emphasizing their role as innovative learning tools essential for developing key skills. The accessibility of serious games presents a complex challenge due to varying technological infrastructures and digital resource access, necessitating a comprehensive approach to address alignment with standards, systemic inclusion, and accessibility challenges. This approach fosters a unified educational environment, maximizing the pedagogical benefits of serious games for students.

3.2 Communication Strategy

The communication strategy for a serious game is crucial for reaching the target audience and maximizing educational impact [2]. This involves channels like educational conferences, teacher association collaborations, webinars, educational journal publications, online platforms, and partnerships with national educational authorities. The target audience includes teachers, school principals, educational administrators, parents, and students, each with specific information and training needs to ensure a clear understanding of the game's pedagogical benefits [10]. Key messages should

highlight the game's benefits for student learning, alignment with educational objectives, adaptability to teaching contexts, potential to enhance student engagement, and integration into curricula, emphasizing its enjoyable and educational aspects. Engaging communication materials, such as online platforms, social networks, testimonials, practical guides, and other resources, are essential for an effective strategy to maximize the game's diffusion and promote its integration into the educational environment.

3.3 Resources and budgets

Implementing a serious game diffusion strategy requires understanding educational financing. Funding sources include municipalities, school cooperatives, teachers, and cooperative classes. Public funding covers teacher salaries, infrastructure, and educational equipment, supplemented by local funds to meet local educational needs. This collaboration supports initiatives like integrating serious games, improving digital infrastructure, purchasing technology, and providing teacher training. Parental involvement through fees, contributions, or purchases varies, with additional support from government grants, private funds, and donations. Understanding budget allocation for staff salaries, operating costs, and educational activities ensures successful integration of serious games into national educational systems.

4 CASE STUDY: "LINO HAS AN IDEA"

Once this general method is established, it is possible to put it into practice. This article will address the case study of the serious game « Lino has an idea » We will then revisit the various steps and apply them for nationwide dissemination in France.

4.1 Presentation of the serious game "Lino has an idea"

The serious game introduces concepts for subsequent study [12]. Designed for children in grades 2 and 3, it teaches innovation processes and creative techniques, fostering skills like communication, autonomy, and teamwork. The game includes a board, dice for idea generation, a pawn representing character Lino, a notebook for jotting ideas, and trick cards. It starts with Lino sharing a dreamt innovation idea. Children follow Lino's 7-step innovation process, using trick cards for creativity. They work in groups, sharing ideas under adult supervision.

4.2 Integration into Educational Programs

The game « Lino has an idea » is a comprehensive educational resource designed to develop various skills in students [7], [8], [12]. It is crucial to ensure its pedagogical legitimacy and adaptability to educational programs. The game « Lino has an idea » naturally aligns with the educational programs for students aged between 6 and 11 years old (cycles 2 and 3 of the French national education system). Its pedagogical integration aims to cover a broad range of skills, thereby promoting the development of students.

Table 1. Evaluation of the skills addressed by the game across the programs of cycles 2

Domain	Evaluated Skills	Number of Skills Fulfilled by the Game
Cycle 2		
Language for thinking and communicating	Understanding and following short and simple instructions	3/11
Methods and tools for learning	Finding solutions to solve a comprehension problem	1/3
Personal and citizen formation	Defining and respecting organization and task sharing in group work	3/3
Natural and technical systems	Understanding and respecting the rules of a game	1/3
Representations of the world and human activities	Expressing felt emotions, formulating opinions	1/3
Proportion of the number of skills addressed across the entire curriculum[1]		9/23

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[1] Data obtained by extracting the skills from cycles 2 and 3 filled by the game "Lino has an idea," the percentages represent the proportion of skills covered by the game compared to the total number of skills.

Table 2. Evaluation of the skills addressed by the game across the programs of cycles 3

Domain	Evaluated Skills	Number of Skills Fulfilled by the Game
Cycle 3		
Language for thinking and communicating	Understanding written instructions, identifying relevant information in descriptive writings, reacting to proposals, dialoguing	8/15
Methods and tools for learning	Finding solutions to solve comprehension problems, planning steps and tasks for the realization of a production	2/4
Personal and citizen formation	Defining and respecting organization and task sharing in group work	3/3
Natural and technical systems	Understanding and respecting rules, applying a scientific or technological approach to solve problems	2/3
Representations of the world and human activity	Expressing emotions, formulating opinions, perceiving moral issues, demonstrating critical thinking	3/4
Proportion of the number of skills addressed across the entire curriculum[1]		18/29

Based on our findings, "Lino has an Idea" effectively integrates into educational programs for cycles 2 and 3, covering a broad spectrum of skills (Table 1 and 2) from understanding instructions to applying scientific methods. As a versatile serious game, it fosters creativity and critical thinking, demonstrating its relevance in education and its ability to meet specific educational requirements. Our research indicates that "Activités Pédagogiques Complémentaires" (APC or Additional Pedagogical Activities) are ideal for implementing "Lino has an Idea," supplementing traditional teaching methods to deepen students' knowledge and enhance skills. The game aligns perfectly with APC objectives in cycles 2 and 3, focusing on creativity, teamwork, problem-solving, communication, autonomy, and innovative pedagogical practices. Engaging teachers in discussions about the game's objectives and adapting content based on their feedback ensures effective integration of "Lino has an Idea" into education, enhancing student learning and development.

4.3 Communication Strategy

Developing an effective communication strategy is crucial for disseminating "Lino has an Idea." We used information from interviews and conducted research on preferred information channels, online educational content, and similar initiatives. This helped identify the best channels for large-scale deployment of "Lino has an Idea.".

Personal research indicated that in France, social networks and websites are key for promoting educational activities. For websites, we created a ranking (Figure 2 left) based on site popularity (ranking in the global educational sector) and traffic rate (monthly visits). These criteria show the site's usage in France, professionalism, and recurrence in education. A scatter plot (Figure 2 right) ranked websites based on these criteria, with higher and more left points indicating more relevant sites, highlighting the top five. This analysis targets platforms best suited for disseminating "Lino has an Idea," ensuring visibility on sites frequented by the educational community.
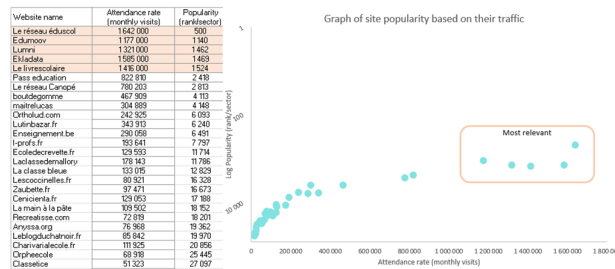

Figure 2. Ranking and Evaluation of Educational Websites (SimilarWeb)

Here are five key sites for our study. Eduscol, from the French Ministry of Education, provides resources and promotes best practices. Lumni (formerly France.tv Éducation) offers diverse educational content for free, emphasizing accessibility and equal opportunities. Instagram and LinkedIn are popular in France, reaching teachers and education professionals. The communication strategy must adapt to each platform, using evaluation tools to position "Lino has an Idea" as an essential educational resource.

4.4 Resources and Budgets

In France, serious games can be funded through various channels. According to the Ministry of National Education and Youth's "Repères et références statistiques 2023" [13], education expenditure in 2021 is structured across different funders, including:
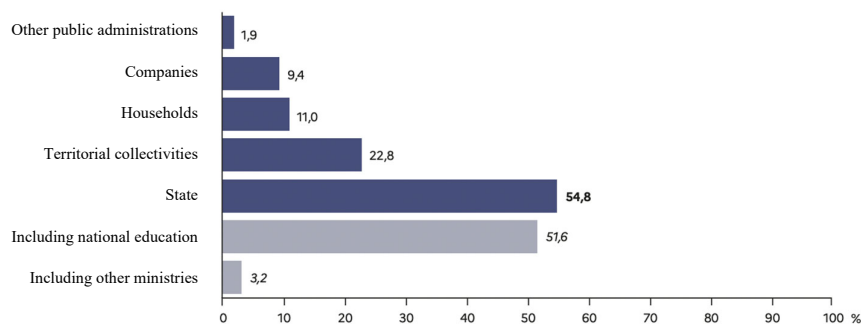

Figure 3. Distribution of education funders in France in 2021

Among these funders are local authorities (especially municipalities), school cooperatives, cooperative classes, and direct contributions from parents. The municipality allocates a budget to primary schools for investment and operating expenses. For "Lino has an Idea," the process includes developing a formal proposal with cost, pedagogical justification, integration into classes, and expected impact; presenting this to the school administration; and submitting to the municipality for budget adjustments if accepted. The School Cooperative, managed by teachers and sometimes parents, can contribute through activities, donations, subsidies, and member contributions. In a Cooperative Class, students, under the teacher's guidance, can integrate the game into their projects and propose funding ideas, promoting autonomy. Direct Contributions from Parents allow parents to support specific class projects.

These processes require meticulous preparation, solid pedagogical justification, and effective communication with stakeholders. Speed and accessibility vary by funding source. Collaborating with associations or companies linked to Ecole Nationale Supérieure des Arts et Métiers in Paris, where the game originated, is crucial. The "Main à la pâte" foundation [14] aligns with our expectations for integrating a serious game into cycles 2 and 3 classes. Targeting relevant websites (figure 1) and publishing the game through a publishing house would ensure direct promotion, including school visits, and word of mouth would boost visibility.

5   DISCUSSION

To address our issue, the best method of disseminating a serious game in the educational realm is methodological. Understanding the stakeholders' needs before developing the game, as observed with the implementation of "Lino has an Idea" in France, is crucial. It's essential to align the game with the targeted school curriculum. Thoughtful mobilization of funding is also vital. Therefore, understanding the landscape before developing a serious game in the educational environment is necessary. The distribution of "Lino has an Idea" can be facilitated through financial support from local authorities in schools. An effective communication strategy through social networks or websites allows a serious game to gain recognition. Strategic platforms like Eduscol have proven to be more effective in this regard.

6   CONCLUSIONS AND PERSPECTIVES

The in-depth analysis of integrating "Lino has an Idea" into education highlights several key points. Its alignment with teachers' expectations and educational objectives provides a solid foundation for adoption. Field trials, both physical and digital, support this alignment. The dissemination strategy focusing on social networks and popular websites aims to maximize visibility, specifically targeting

teachers and education professionals on platforms like Instagram and LinkedIn. Integration into "Activités Pédagogiques Complémentaires" (APC) aligns the game's objectives with students' needs in this context.

Collaboration with teachers and content customization based on feedback allows relevant adjustments. Diverse funding approaches, from municipal funding to direct parent contributions, require a strategic approach. The formal proposal, highlighting cost, pedagogical justification, and expected outcomes, provides a framework for local budget negotiations.

In conclusion, the prospects for "Lino has an Idea" are promising. Its potential for integration into cooperative classrooms offers new avenues to diversify pedagogical approaches and enhance impact. The success of its communication strategy, combined with a strategic approach to funding, positions this game as an innovative and adaptive educational tool for cycles 2 and 3.

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