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STEM Education Strategies Within the Sporting Context

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Abstract

The Basque Lanzadera Project (BLP) is an initiative to boost STEM competences adopting strategies that have been successfully used in a sports environment. This project starts within the framework of the "Etorkizuna Eraikiz" program in the Basque Country. This is a strategic framework of public policies launched by the Provincial Council of Gipuzkoa. It is based on experimentation, innovation and public and private collaboration as an instrument to overcome the main challenges that the territory is presented with. The purpose of this project is to promote STEM skills through the creation of teams of young people, who will participate in local and international STEM competitions. The main challenge is how to achieve a competition-based learning model in STEM which goes beyond formal or extracurricular training. The creation of a network based on collaboration, cooperation and competition, it what is proposed and which is internationally replicable in order to expand a new model of STEM education.

Keywords: *STEM education, learning strategies, sporting context, cooperative-collaborative learning, teaching-learning strategies, Competition-Based Learning.*

Introduction

The Basque Lanzadera Project (The Basque Shuttle Project) is being presented for the development of STEM competencies in young people from the province of Gipuzkoa, Basque Country, Spain. It is a project that has been recently promoted within the framework of Etorkizuna Eraikiz, a program run by the Provincial Council of Gipuzkoa. Etorkizuna Eraikiz is an action-research process that, is meeting the challenge of moving towards more collaborative forms of policymaking in the provincial Council of Gipuzkoa. Etorkizuna Eraikiz facilitates the financing of projects proposed by citizens. The initiative is part of the citizen´s proposals financially supported by the Provincial Council of Gipuzkoa in 2017. The main contribution of this paper is the use of Competition-Based Learning (CnBL) to design a methodological process of STEM learning and teaching through competition, building up an ecosystem of learning with mechanisms and a culture similar to sports competitions.

This document is divided into three sections. First of all, the paper presents the main strategies adopted to boost STEM acquisition among youth in UK and Europe, and what are the main features of these improvements. Afterwards, the methodological proposal is presented below followed by both the expected and obtained results. Finally the conclusions are presented and some elements that invite debate about the model are illustrated.

This project aims to facilitate the overcoming of the barriers and obstacles that the current STEM integration strategies are presented in higher education, and on the other hand, it aims to offer a response to STEM training in primary and secondary education.

New challenges in STEM education strategies

It's a widely accepted idea the fact that workers in STEM (science, technology, engineering, and math) fields play a direct role in driving economic growth. STEM sectors are seen as a cornerstone of economic growth and as such are particularly important in terms of global competitiveness. (The supply of and demand for high- level STEM skills, 2011). Both by the scientific education community and the policymakers, STEM training from a young age has been marked as a priority, in order to increase the knowledge of citizens with regard to STEM skills, as well as to increase the number of students studying STEM subjects in higher education. Each region faces the challenge of increasing the STEM competencies of its students and the educational community, from its current reality and context (Williams, J., 2011).

This has provoked the sudden appearance of strategies and proposals, that have brought to light a very wide range of resources, methodologies and educational programs (Honey M., Pearson G., and Schweingruber H., 2014). There are innumerable reflections published around the barriers that hinder

the advancement of school STEM learning strategies. As a result, the need to look for new ways to face this challenge appear. (Kelley, T.R. and Knowles, J.G., 2016). On one hand, due to this context, the effective formulation of integrated educational strategies, are required connecting different learning situations as an integrated system (Kelley, T.R. and Knowles, J.G., 2016). While on the other hand, STEM learning strategies have generally been applied in higher level education and not so much at lower levels of education. (Honey M., Pearson G., and Schweingruber H., 2014).
Even if an integrated curriculum was possible (DeCoito I.,2014) another area of discussion arises. How could elementary and high school teachers develop the expertise required in all STEM subject to provide an integrated approach? (Williams, J., 2011)
In addition the implementation of many strategies of STEM learning within curriculum structures have showed a lot of resistance to change. (Williams, J., 2011) Among others we can highlight a lack of connection with learners and a lack of hands-on training for students. (Chiu A., Price C.A., Ovrahim E., 2015). The students do not seem to be very motivated by what happens inside the classroom. (Williams, J., 2011)
Despite all these difficulties, there is little research on how to improve it or on what factors actually stimulate learning, interest, retention or performance (Honey M., Pearson G., and Schweingruber H., 2014). The BLP is presented as a proposal for action aimed at overcoming these obstacles and providing useful knowledge. STEM training ecosystem integrats all subjects, that apply to primary and secondary students and that is compatible with the school curriculum. The new ecosystem is easily scalable, motivating and stimulating, not only to the students but to the entire community.

The Basque Lanzadera Project. The value of the sporting context

This case is framed within Etorkizuna Eraikiz that is an action-research program oriented towards a new form of governance of the territory. Etorkizuna Eraikiz is based on an innovative system of shared deliberation with the citizens and the main agents and territorial institutions of Gipuzkoa in order to effectively face their main challenges for the future. One of the main challenges identified has been the improvement of competitiveness. Financing programs from citizen´s proposals based on collaboration have been activated, through innovative projects, turning the great strategic challenges of economic and social globalization into opportunities. This project is considered by Etorkizuna Eraikiz as an educational innovation project and it is evaluated as a project that focuses on improving employment counselling for young people.
The methodological strategy aims to encourage the creation of a STEM league in Gipuzkoa and the Basque Country. The main goal is to encourage and enable the existence of a culture of STEM tournaments in Gipuzkoa. This project promotes STEM skills from a sporting point of view. STEM sports tournaments must be linked to companies and to schools and culminates in an international final. Each tournament will be run and sponsored by one or more companies related or interested in the activity. The purpose is to create an ecosystem of STEM training competitions, with an architecture similar to sports competitions, connected internationally under the framework of a tournament, with the winner providing the best resolution to a STEM challenge. Among the advantages of the competitive approach we may name: interactivity, collaborative work inside a group, active participation, challenge and motivation for the students to explore their own subject-matter. Furthermore it has the additional benefit in terms of social impact of engaging the wider community such a parents, enterprises and teachers.
This project aims to provide a STEM solution through implementing a methodology that is easily and globally replicable, and where stakeholders live an intense experiences of collaborative learning through STEM.

Results

Although it is still early to present solid results about its impact and its methodology, an initial analysis allows us to show some previous results. In quantitative terms, to start the 2017/2018 campaign five tournaments were selected, from the hundreds that exist. The tournaments are “Airbus fly your ideas”, “ESA Cansat competition”, “CERN Beam for schools”, “First Lego League” and “Odyssey”. In 2017 a Basque school team participated directly in the European Final after winning the Spanish Final. In 2018, was organized a preliminary tournament, “Cansat Euskadi”, whose winner was awarded a place in “Cansat Spain” and subsequently in “Cansat Europe”.
Overall a high level of participation has been achieved with more than 15 companies, 20 educational centers and 4 Universities taking part.

In qualitative terms we can offer the following results. STEM competition allows for the building of children's practical science skills and knowledge through multiple experiences. It successfully engages families, increases mutual understanding and creates the capacity among parents to support their children's learning. The learning space created in this sporting ecosystem is a meeting point where companies and educational centers can work and benefit each other.The students need both, the support of companies that have specialized knowledge and teachers who will provide general knowledge. Therefore, the young who compete in a group are more socially integrated, have an increased desire to work hard to achieve a specific goal and also gain prestige in their community. Through offering STEM activites in the form of a tournament, the schools aditionally experience the added benefit of encreased enrollments. Furthermore, the sense of belonging to a club creates stronger bonds and greater affiliations and encourages the participation of parents, friends, and the community as a whole. Therefore it contributes to positive social visibility and strengthens positive self-esteem. This methodology allows for participation from very early ages, which seems to increase the chances of a student being on track to ultimately register for STEM degree programs (Dejarnette, N.K., 2012).

Conclusion and Discussion

In conclusion, STEM in a more connected way, especially in the context of real-world issues, that can make STEM subjects more relevant to students and teachers. This in turn enhances motivation for learning and improves student interest, achievement, and persistence. (Honey M., Pearson G., and Schweingruber H., 2014).

The implementation of a STEM learning strategy through a new competition ecosystem centered around challenges that stimulate all agents involved. Nonetheless, some unknowns derived from the recent project start-up are still open. Mainly the lack of an evaluation model that allows obtaining short-term results regarding the effectiveness of the project. Nonetheless it seems interesting to explore the way in which the participation of schools is reconciled with the curriculum and school schedule.

Finally, it is worth reflecting on the suitability of imposing the STEM culture on the entire educational community. (Pit (2009) and Millar (2006)). The BLP model offers a proposal that is not imposed but rather is a facilitator, because offers the opportunity to identify STEM talent and / or vocations within a stimulating and attractive environment.

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