**PYTHAGORAS Learning activity Report**

**INNOVATIVE STRATEGIES FOR TEACHING AND LEARNING MATHEMATICS**

**Training for teachers**

**11th – 15th March 2024**

**University of La Laguna, Tenerife (Spain)**

This report aims to present the findings and analyze the level of satisfaction expressed by the participants which attended the **Training for teachers**, titled **Innovative strategies for teaching and learning mathematics**, organized by the **University of La Laguna between the 11th and 15th of March 2024**.
This learning activity was designed for the teaching staff (professors, assistant professors, lecturer, researcher) from the 7 higher education institutions from the consortium involved in this project, where the facilitation of the sessions planned were divided among the specialists from the project´s partners.
The goal of this workshop was to promote a mathematics education that is connected to the real world, facilitating understanding and not just knowledge of mathematical processes.

To reach the goal, the workshop was focus on three key areas:

**1. Mathematics connected to the real world:**

• Sustainable Development Goals (SDGs) as a framework to contextualize mathematics and show its relevance in everyday life.

• Mini-pbl (project-based learning), where students address real and relevant problems for their environment.

**2. Incorporation of ICT tools:**

• Exploring different digital tools that can be used to facilitate the teaching and learning of mathematics.

• How ICT can help students visualize mathematical concepts, work collaboratively, and develop critical thinking skills.

**3. Innovative teaching strategies:**

• Scrum to promote active participation and teamwork in the classroom.

• Different self-assessment proposals that allow students to take control of their own learning.

• Sharing experiences and good practices to address the diversity of the student body, including students at risk or with difficulties in mathematics.

**Workshop program**

| | MONDAY 11th | TUESDAY 12th | WEDNESDAY 13th | THURSDAY 14th | FRIDAY 15th |
|---|---|---|---|---|---|
| **Institution** | **ULL** | **IPP + STU** | **HMU** | **KAU + SBU** | **AAU** |
| **09:00 – 11:00** | Mini-PBL, ICT & SDG (I) | Edu_Scrum method (I) IPP | Appliying Scrum in mathematics (I) | STACK (I) SBU / KAU | Gamification (I) |
| **11:00 – 11:30** | Coffee-Break | Coffee-Break | Coffee-Break | Coffee-Break | Coffee-Break |
| **11:30 – 13:00** | Mini-PBL, ICT & SDG (II) | Edu_Scrum method (II) STU | Appliying Scrum in mathematics (II) | STACK (II) SBU/ KAU | Gamification (II) |
| **15:00 – 16:30** | - | - | Project Meeting | Workshop assessment | Visit to Garachico |
| **20:00** | - | - | Dinner "La Hierbita" | - | Dinner "Patio Canario" |

The satisfaction survey was conducted immediately after all the workshops of the week´s event have finished to evaluate its effectiveness and gather valuable feedback for future improvement.

**Methodology:**

The survey applied to the workshop´s participants used a 4-point scale, from 1 (very poor) to 4 (excellent), where each section of the workshop was evaluated individually in order to receive feedback for each area.

**Findings:**

The survey results revealed an **overwhelmingly positive response from participants**. A significant majority (nearly all) rated the workshops as either 'excellent' or 'good' across all evaluated aspects, including presentations, materials, dynamics, and facilitator skills, **indicating a high level of satisfaction and a successful event that met or exceeded their expectations.**

The evaluation was conducted for each workshop conducted in the one week event and the results will be presented below:

## 1. Mini-PBL, ICT and SDG

This workshop was evaluated positively by all the participants, being qualified as *very pedagogical* and *interesting and inspirational*, but mostly very practical - *The idea is to use this approach as motivation to students in order to see how maths is useful not only in the specific field of your professional career, but also in everyday life.*

According to 83.33% of participants, the presentation effectively communicated the methodology with clear explanations and relatable examples, earning an 'excellent' rating. The remaining 16.67% found it good, but still satisfactory. Overall, the presentation was well-received by the majority of participants.

As some participants would have appreciated more depthness of each topic, 58.82% appreciated the workshop as excellent and 41.17% as good in this aspect, with comments like:
*Maybe an example from real life, problems of electronic engineer (EE), since my students are EE*
*I would like to experiment it as real time, to have some exercise to test the ideas.*

All the participants had high praise regarding the quality of the organization and presentation of the workshop. Although some attendees felt that certain topics could have benefited from more in-depth coverage, the majority of participants (76.47%) found the workshop materials to be excellent, while 23.53% considered them good. Overall, the materials were well-received by most participants, with some expressing a desire for additional information on specific topics.

Despite some suggestions for increased interactivity, the workshop was universally praised by attendees. The majority (82.35%) found the activities to be highly effective in promoting understanding of the topic, and 70.58% appreciated the opportunities for participation and interaction. The facilitator's skills were widely regarded as excellent, with all participants rating their knowledge, communication, and facilitation abilities highly.

The workshop sparked significant interest among attendees, with 64.70% expressing a desire for additional resources or follow-up sessions. Furthermore, 76.47% of participants plan to apply the strategies they learned in their own classrooms, indicating a strong likelihood of sustained impact:
*Mini-PBL is a good way to address PBL in short courses. I will try to apply as a lab for students in teacher education.*

*Maybe I can design a mini PBL for my students, based on real life problems of Electronic Engineers, for my course.*
*There were some interesting ideas, I would like to apply in applied mathematics.*
*I would like to integrate the proposed software (DESMOS) with the pre-calculus course. I will use the SDG the real life cases to extract data for students to apply.*
*The approach of using AI and involving the students critical thinking to find their own dataset are very important towards innovating teaching. I will definitely use these two approaches in my classroom.*

**2. Eduscrum in Action: A PBL journey towards sustainable solutions (Part I)**

Although one attendee felt the workshop was not engaging and did not plan to use it in the classroom, the majority of participants gave it high marks.

Specifically, 64.70% found the explanations clear, 70.58% found the practical examples and applicability to their own classrooms excellent, and 70.58% found the depth of each topic excellent. Overall, the workshop received a very positive evaluation from most attendees.

An overwhelming majority of attendees (76.47%) praised the workshop's organization and presentation, as well as the relevance and usefulness of the materials provided.

Almost all participants (94.11%) rated the workshop's dynamic as excellent and good, praising the activities, interaction, and time allocated to each section, with no areas for improvement reported.

An overwhelming majority of participants (94.11%) found the facilitator's skills exceptional, praising their knowledge and mastery of the topics, clarity of communication, and effective group management.

However, nearly half of the participants faced challenges in integrating the methodology into their classroom practice, citing limitations in their own knowledge, adaptability to their specific context, or a mismatch with their existing teaching approach:
*It is extremely difficult to apply PBL in a classroom of 150 students as in our university.*
*I need to learn more about it.*
*Probably I will not use this method in the near future.*

**3. Eduscrum in Action: A PBL journey towards sustainable solutions (Part II)**

This workshop was highly appreciated by all the participants, finding it very insightful and the method very interesting.

*Interesting application to calculus course.*

*It was very insightful. I liked very much the combination of eduscrum approach with the frequent testing.*

*Very interesting method*

The majority of attendees (93.33%) praised the presentation's clarity, with excellent explanations and practical examples that were easily applicable in the classroom. Additionally, 80% of participants found the depth of each topic to be exceptional, providing valuable insights and knowledge.

All the attendees evaluated as good and excellent all the materials, 93.33% considered it excellent in terms of quality of organization and presentation, 73.33% highly appreciated their relevance and usefulness.

The workshop's dynamics received widespread acclaim from all participants, with a staggering 93.33% rating the opportunities for participation and interaction as excellent. Additionally, 93.33% found the time allocated to each section to be well-suited, and 80% praised the effectiveness of the activities in facilitating a deep understanding of the topic.

The facilitators' skills and professionalism were universally praised by participants, with a notable 80% rating their knowledge and mastery of the topics as excellent. Additionally, 86.66% found their communication skills to be exceptional, conveying complex ideas with clarity. Furthermore, 66.66% commended the facilitators on their effective facilitation and group management skills, creating an engaging and productive learning environment.

Overall the workshop had a very pedagogical presentation getting the participants interested, 20% of the participants had clear ideas on how to implement the strategies learned in their classroom.

*I would like to try a similar approach in my calculus course.*

*I´ve had a lot of ideas on how to use the Excel-documents.*

*I will integrate the frequent testing with SCRUM sessions.*

## 4. How to apply scrum in Mathematics: Two case studies in setting up events and new projects

The workshop received a positive response from nearly all participants, who appreciated the approach and strategy presented. However, some noted that it may be more challenging to implement with younger students, finding it more suitable for master's and PhD students. Additionally, they highlighted the need for further human resources support.

*I need to adapt the method, since we have less main-power resources.*

*I have no classroom in which I could implement strategies this way.*

*It is not possible in basic programme with university freshmen.*

*I think it´s quite difficult to apply it in my classroom because I can´t be the master scrum of all my students and I haven´t nobody to do it.*

*Nice method and strategy for more advanced students in master of PhD Study Programmes, we will try to implement, especially with PhD Students.*

Despite these limitations, 100% of participants praised the presentation as excellent or good in terms of depth, with 61.11% rating the practical examples and applicability in the classroom as excellent. Furthermore, 77.77% highly appreciated the clarity of the explanations provided.

The quality of the workshop's organization and presentation of materials received positive feedback from all attendees, who uniformly commended its excellence and good. Moreover, a significant 72.22% of participants found the materials provided to be extremely relevant and useful.

All participants positively evaluated the workshop's dynamics, commending the effective balance of activities, interaction, and time allocation. Specifically, 83.33% found the activities to be very effective in facilitating understanding of the topic, while 77.77% highly appreciated the opportunities for participation and interaction provided. Additionally, all participants rated the time allocated to each section as good or excellent.

Furthermore, the facilitators' skills received widespread acclaim, with 83.33% considering their knowledge and mastery of the topic, as well as their clarity and communication skills, to be excellent. Furthermore, 77.77% also evaluated their facilitation and group management skills as excellent.

While some participants noted that the methodology presented in the workshop was challenging to implement in their classroom due to limited resources or difficulties in adapting to their students' level, nearly 50% of attendees expressed a strong interest in accessing additional resources or participating in follow-up sessions to further support their implementation of the methodology.

### 5. Innovating methods for teaching and learning: constructing and implementing examples in a computer assessment system (STACK)

The overall evaluation of the workshop was positive, being appreciated as *Very interesting, very inspirative, very well prepared*, although presents challenges in terms of implementation and development:

*It needs a lot of time to invest initially, but in the end you gain too much time correcting and sending grades.*

*We would like to involve IT. After hard work with development, we can benefit a lot in a large pool of different problems to solve for individualization of study, teaching and personal approach to student´s needs.*

The presentation received widespread acclaim, with all participants rating it as good or excellent. Specifically, 81.25% of attendees considered the explanations clear and excellent, while 93.75% found the practical examples and classroom applicability extremely good. Furthermore, 75% appreciated the depth of each topic presented as excellent.

All the materials were highly appreciated by the participants, 93,75% considered highly relevant and useful the materials and all of them considered good and excellent the quality of organization and presentation of the materials.

The workshop's dynamics also received exceptional praise from all participants. A significant majority, 87.5%, found the activities to be highly effective in promoting understanding of the topic, and 93.75% felt that the time allocated to each section was well-managed. Furthermore, 93.75% of attendees valued the opportunities for participation and interaction offered during the workshop.

The facilitators' skills were also highly commended, with 93.75% considering the facilitator's group management skills and overall facilitation to be excellent. Additionally, 87.5% praised the facilitator's knowledge and mastery of the topics, as well as their clarity and communication skills.

Despite initial concerns about implementing the methodology in their university or classroom, participants showed a willingness to try it out. However, they recognized the need for additional support and training to ensure successful adoption. As a result, 43.75% of attendees expressed interest in receiving additional resources or participating in follow-up sessions to further develop their skills and confidence in applying the methodology.

## 6. From theory to praxis: Gamification in a University math-related education

The Gamification workshop was evaluated by most participants as the best workshop of the training for teachers, with 76.47% of the attendees interested in receiving additional resources or participating in follow-up sessions on the methodologies:

*I love this workshop.*

*Best workshop this week!*

*Very interesting, engaging and motivating. New ideas on how to use gamification were born.*

*Good summary of the gamification theory with practical examples.*

*Excellent presentation and very interactive workshop.*

The workshop's presentation received an overwhelmingly positive evaluation from all participants especially in the depth of each topic addressed in the presentations. An impressive 94.11% praised the clarity of the explanations, while 76.47% highly valued the practical examples and their relevance to classroom teaching.

The workshop materials received excellent feedback from all participants. A significant 88.23% of attendees praised the materials' relevance and usefulness, while 94.11% commended the excellent quality of organization and presentation.

The workshop was deemed highly engaging, with all participants feeling empowered to participate and interact throughout. This led to 94.11% of attendees considering the activities highly effective in helping them understand the topics, while 70.58% believed the time allocated to each section was sufficient.

The facilitator, received widespread praise for his exceptional skills - *Giorgios is a wonderful presenter, professional and organized*. An impressive 94.11% of participants rated his knowledge and mastery of the topics as excellent, while 88.23% highly valued his clarity and communication skills, as well as his ability to facilitate and manage group discussions.

The overall satisfaction with this workshop was clearly demonstrated in the openness of all the participants to integrate the methodology learn in their classrooms, adapted to each ones reality and possibilities:

*I am planning to develop a game that will be part of my assessment for the students learning and grading.*

*Introduce the gamification into my lectures.*

*I intent to apply in probabilities and statistics course. At a first stage with a group work split into 4 different sprints with gamification.*

*Integrating more gamification strategies in my classroom, because I already use it but now I know something more.*

*I will play with students ¨quantity-unit¨memory game.*

*We will define some games for our students and use it in the basic maths courses.*

*I will make use of gamification and discuss it with my colleagues.*