(09-027) - Ornamental plants -kahoot and roulettes-to identify the most typical ornamental species to use designing 3D projects.

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Gamification activities have emerged with great force in recent years showing an improvement in the motivation and performance of students. Therefore, several gamification activities have been implemented for the learning of the most typical species of trees and shrubs required within the subject of Gardens and Green Areas, of the Degree in Forestry Engineering at the Polytechnic University of Madrid (UPM). We developed these tools in two Educational Innovation Projects "Learning through gamification processes of the most typical species of trees and shrubs in gardens and green areas (I and II)" (IE22. 1301 and IE23.1305) at Universidad Politécnica de Madrid, experiences 2020-2024.

We developed these tools: list of species, catalogue of species, practices: species I and II (interactive map, individual games: roulettes; video-game; kahoot), to finally develop a landscape project of a 3d garden. We explain Kahoot in detail and the roulettes, with different levels of difficulty according to the legend of the species, allow pupils to practise at home the individual recognition of plant species. If we analyse the survey data on the application of these tools (scale from 0 to 10), almost 90% considered them to be important, useful and motivating.

Keywords: Gamification, forestry engineering degree, Parks and Gardens; kahoot; roulette; species;

Gamificación en Parques y Jardines: ornamental plants -kahoot y ruletas- para el reconocimiento de las especies ornamentales más típicas

Las actividades de gamificación han surgido con gran fuerza en los últimos años mostrando una mejora en la motivación y el rendimiento de los estudiantes. Por ello, se han implementado diversas actividades de gamificación para el aprendizaje de las especies más típicas de árboles y arbustos requeridas dentro de la asignatura de Jardines y Zonas Verdes, del Grado de Ingeniería Forestal de la Universidad Politécnica de Madrid (U.P.M). Desarrollamos estas herramientas en dos Proyectos de Innovación Educativa "Aprendizaje mediante procesos de gamificación de las especies más típicas de árboles y zonas verdes (I y II)" (IE22. 1301 e IE23.1305) de la Universidad Politécnica de Madrid, experiencias 2020-2024.

Desarrollamos estas herramientas: listado de especies, catálogo de especies, prácticas: especies I y II (mapa interactivo, juegos individuales: rulets; video-juego; kahoot), para finalmente desarrollar un proyecto paisajístico de un jardín en 3d. Explicamos en detalle Kahoot y las ruletas, con diferentes niveles de dificultad según la leyenda de las especies, permiten a los alumnos practicar en casa el reconocimiento individual de especies vegetales. Si analizamos los datos de las encuestas sobre la aplicación de estas herramientas (escala de 0 a 10), casi el 90% las consideró importantes útiles y motivadoras.



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Palabras clave: Gamification, forestry engineering degree, Parks and Gardens; kahoot; roulette; species;

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1. Introduction

The evolution of the Education at the University has consistently pursued innovative educational methodologies to the diverse learning styles and complexities of student populations. This fact is further necessitated by the rapid progression of technological advancements and the imperative to cultivate generic skills that are increasingly demanded by contemporary society. Historically, educational strategies at all levels have leveraged various forms of gaming, thereby embodying the essence of game-based learning. The concept of "gamification" emerged prominently in educational discourse around 2010, likely inspired by the transformative impact of the video game industry (Smith, J. & Jones, M., 2021).

Gamification in education transcends traditional game-based learning by integrating game elements to enrich the learning experience, thereby boosting student motivation and engagement (Turner, A., 2019). This approach encompasses a variety of game-like elements such as challenges, collection of items, rewards, budgets, and the selection of player profiles, allowing educators to tailor the learning environment. Through controlled gaming scenarios or the incorporation of motivational game elements, teachers can significantly enhance the learning process (Harrison, D. & Thomas, P, 2020). Students engaged in gamified learning activities typically report heightened feelings of enjoyment, competition, motivation, and overall satisfaction, correlating with an improved quality of learning (Bell, R. & Keller, L., 2018). Crucially, the integration of gamification into educational settings does not necessarily require the direct use of video games; rather, the engaging aspects of gaming environments are leveraged to captivate students' interests (Foster, A. & Knox, J. 2019).

Empirical evidence supports the effectiveness of gamification in promoting student progression through educational content, influencing behaviour, and fostering motivation (Nguyen, C. & Hoang, A, 2021). Designing gamified learning experiences poses a creative challenge for educators, balancing fun and engagement with deep engagement in curricular content.

This study explores the potential of gamification to enhance the learning experience in the subject of "Parks and Gardens" (Escuela Técnica Superior de Ingenieros de Montes, Forestal y Medio natural at the Universidad Politécnica de Madrid). The gamification tool developed in the present projects were developed in two Educational Innovation Project "Learning through gamification processes of the most typical species of trees and shrubs in gardens and green areas (I y II)" (IE22.1301_UPM and IE23.1305_UPM), (Hernando Gallego, A. et al., 2022) and (Hernando Gallego, A. et al., 2023) and the educational classes experiences 2020-2024.

2. Objectives

The objective of this study is to develop a series of tools aimed at motivating and facilitating the study of the species list in the subject of Parks and Gardens, and the Restoration of Degraded Spaces (U.P.M).

The specific objectives are:

- To classify plant species into blocks of importance for learning purposes.
- To develop individual games of varying difficulty levels for personal student engagement at home.
- To develop group games of varying difficulty levels for collaborative student engagement in class.
- To create a real garden project, selecting the species that have been learned.
- Evaluate the importance of gamification tools in the learning process.

3. Methodology

In the subject of "Park and Gardens and Restoration of degraded areas" of the Forestry Engineering Degree (Polytechnic University of Madrid, U.P.M, Spain), a list of most typical species of trees and shrubs species must be studied. It is a total of 230 species. The students must learn the name (vulgar and Latin) of all these species and recognize them. However, our experience shows that the process requires time, effort, and a lot of repetition until the objective is achieved. First, it is necessary to learn the name of the species and then also to relate it to its habit and most common characteristics. This proposal aimed to complement the learning process by playing, and thus facilitate this arduous task.

The teachers of the subject, after 4 years of different experiences (2020-2024) to teach the list of species, have come to the conclusion, for the present course 2023-2024, that the list of 230 species, should be divided into different degrees of importance for learning and memorization of the species, in order to simplify and optimize the number and learning. For them, the following classification of species is proposed:

LEGEND of the species list

-Black (100): species already learned in Botany, used in Parks and Gardens. In the Botany course of the course, a large number of forest species can be seen. Many of them are used in green areas (Parks and Gardens). It is considered that these species are already learned, no further emphasis is placed on them, they are taken for granted.

BLOCK I: Essential

- Reds (10): learned in Botany, necessary to remember because of their great use. They are species already learned in Botany, and especially used in Parks and Gardens. For this reason, they should be remembered by the students. They are basic, they are species that appear constantly, they are basic, fundamental to remember.

- Green (30): new species of Parks and Gardens, necessary to remember because of their great use. They are new species of plants that have not been learned in Botany and are especially used in Parks and Gardens.

BLOCK II: Important.

These are species not learned in Botany, and frequently used in Parks and Gardens. For this reason, it is important that they are listed and that the students remember some of them.

- Blue (30): new species from Parks and Gardens, to be known for their use.

All the species of *BLOCK II: Essentials*, are subject to evaluation.

BLOCK III: Complementary

These are species not learned in Botany, and used in Parks and Gardens. For this reason, it is important that they are listed and that the students are aware of their location in the list.

- Dark blue (60): species of interest in Parks and Gardens, to learn about their use.

In order for learning to be effective, it is proposed to the student:

3.1. Elaboration of a list of species, by the teacher: a list of 230 plant species by family is elaborated, with the colors defined in the BLOCKS according to the degree of importance. The species are listed in Latin and vulgar name. A strip of 20 specimens is made, 1 for each group of 2 persons.

3.2. Elaboration of a catalogue of species, by the student: the student must present a catalog of species (30 sps), including specimens with the following number: Block I: 20 sps; Block II: 10 sps. The rules for the catalog are the following. Each species in the catalog must obligatorily contain (otherwise it will be invalid) the following identifiers:

- Number; Location.

- Plant bearing: Species + identifying student (selfie).
- Detail of the plant: with significant elements (leaf, flower, fruit, etc).

This slide MUST NOT contain the name of the species: 1 list of the species in the catalog (on a separate sheet), with <u>the Latin and vulgar names correctly written</u>. It is NOT valid to take pictures in the Escuela Montes, Botanical Gardens, field trips and nurseries. Catalogs are NOT VALID, those not submitted in due time and form.

3.3. Practices: species I and II: consist of visits to the arboretum with an interactive map.

3.3.1 Interactive map: The students are provided with a map of the arboretum of the E.T.S.Ingeniería de Montes, for the visits to the arboretum, 2 days. It is an interactive map that matches the location of the species with its name.

3.3.2. Individual games: of varying difficulty, of personal work for the student at home.

a) Rulets: these are multiple-choice tests showing relevant tree photos and three possible answers (in both Latin and Spanish) for each picture. We used http://vishub.org/ to implement it. We have developed several types of roulettes by colours and by levels.

BLOCK I: Essentials

o Red Roulette:

Basic Red Roulette: with the same pictures as the BLOCK I Teacher's Species List (red). Difficult Red Roulette: with photos from this BLOCK I (red), but not from the Teacher's Species List.

o Green Roulette:

Basic green Roulette: with the same photos from the Teacher's Species List BLOCK I (green). Difficult Red Roulette: with photos from this BLOCK I (green), but not from the Teacher's Species List.

BLOCK II: Important

o Basic Blue Roulette: with the same photos from the Teacher's Species Checklist BLOCK I (blue).

From the BLOCK III block, there will be no roulette, since they are of interest, and are only collected in the lists.

b) Video-game: personal work for the student at home. The video game, recreated as a scenario where a player can walk around, bumping into trees and bushes. When this happens, a query pops-up asking for the bush/tree species, and the player must answer by choosing among three possibilities.

3.3.3. Group games, of varying difficulty, for the pupil in class.

c) Kahoot: questionnaires are made showing a species and it must be recognized by the participants. The bars indicating the number of people who have chosen an option are shown below.

3.4. The elaboration of a 3D-project, by the student:

Finally, the student will be asked to elaborate a 3d project, in which he/she will plan and design the garden of a house. Total area: 216 m2; Area occupied by the garden: 136.25 m2

a) Main entrance: A1: 5.62 m2, and A2: 5.62 m2;

b) Roof garden: B: 45 sqm.

c) Main rear garden: C: 80 sq.m.

IRRIGATION: Water consumption for irrigation: Max 80 m3/year; PLANTS: Species used can be native or exotic at the choice of each group 25 species (attach photo); DELIVERIES: Groups of 2 persons; BUDGET: 3500 euros + VAT; 2D and 3D views plans will be delivered.

3.5. Evaluation

The evaluation is crucial that it is well designed for proper learning, depending on what is asked of the students, they are studied. For the recognition of the species part the evaluation process is as follows:

The students must elaborate and bring to the exam the catalog of species, of the student, with the 30 species as described in the norms; they must be brought <u>printed</u> the day of the exam. It must be submitted tucked in a folder and/or bound. The *exam will consist of submitting (10 sp): 8sp Block I (3 (from your own Catalogue) + 5(from another student) ; 2 sp Block II.* The answer will be considered correct ONLY <u>if both Latin and Vulgar names are correct</u>. The 3D construction project will be evaluated on the basis of the work presented in written and oral form.

3.6. Analysis

We passed a questionnaire asking for this gamification strategy for students' satisfaction. The data obtained refer to the application of an anonymous questionnaire that was sent by means of a Google Form, to be answered as accurately and honestly as possible. Subsequently, work was carried out to analyse and interpret the data.

4. Results

4.1 Elaboration of a list of species, by the teacher:

The list of species given to the students, consists of 230 species, on 2 sheets of paper on both sides, and stapled according to the legend described in the methodology (Figure 1).

Figure 1: List of Species elaborated by the teacher (Source: Antonio García Abril y Ana Hernando).

ÁRBOLES GIMNOSPERMAS	ANGIOSPERMAS
ARAUCARACIAS *Araucaria excelsa Lamb.(C) *Araucaria araucana Molina.	ACERACEAE Acer platanoides L. Acer pseudoplatanus L. Acer opalus Miller.
CUPRESSACEAE Juniperus communis L. Juniperus oxycedrus L. Juniperus phoenicea L. Juniperus thurifera L. *Cupressus sempervirens L.	Acer campestre L. Acer monspessulanum L. *Acer negundo o arce negundo / -*Acer palmatum Thunb. o arce japonés *Acer rubrum L. o arce rojo americano
* <i>Cupressus arizonica</i> Greene o ciprés de Arizona * <i>Cupressus macrocarpa</i> Hartw. Ex Gordon	<i>AQUIFOLIACEAE</i> Ilex aquifolium L.

4.2 Elaboration of a catalogue of species, by the student:

A template (pptx) is made available to the student to follow the example and structure of the species to be submitted (Figure 2).

<section-header>

Figure 2: Catalog of species elaborated by the student (Source: Ana Hernando).

4.3. Practices: species I and II: consist of visits to the arboretum with an interactive map.

Each student is given (Figure 3) a map printed on paper on which he/she must match the names of trees and shrubs with the letter of the location on the map.

Figure 3: Interactive map for arboretum visit (Source: Raul Múñoz Bautista, granted of the Educational Innovation Project "Learning through gamification processes of the most typical species of trees and shrubs in gardens and green areas (II)"; UPM IE23. 1305).



a) Rulets:

Figure 4: Species roulettes (Source: Miguel Gómez, granted of the Educational Innovation Project "Learning through gamification processes of the most typical species of trees and shrubs in gardens and green areas (I)"; UPM IE22. 1301, Raul Múñoz Bautista, granted of the Educational Innovation Project "Learning through gamification processes of the most typical species of trees and shrubs in gardens and green areas (II)"; UPM IE23. 1305).



Check the correct answer:

V X

- O O a) Lagerstroemia indica
- ○ b) Mahonia aquifolium
- ○ c) Pelargonium zonale

Responder

b) Video-game:

Figure 5: Video-game (Source: Miguel Gómez, granted of the Educational Innovation Project "Learning through gamification processes of the most typical species of trees and shrubs in gardens and green areas (I)"; UPM IE22. 1301).



c) Kahoot: questionnaires are made showing a species and must be recognized by the participants. Then, the bars indicating the number of people who have chosen an option are shown.

Figure 6: Kahoot (Source: Ana Hernando).



Which is the specie name of this picture?

4.4 Elaboration of a 3D project, by the student:

The written delivery and oral presentation of the construction project will be made, which will include the relevant 3D views (Figure 7) to better show its execution.

Figure 7: 3D Perspective, 3D project carried out in class practices (Source: Laura Rabanal Paniagua, student of the Forestry Engineering Degree of the E.T.S.I.Montes, Forestal y Medio Natural).



4.5 Evaluation and analysis

When this type of gamification activities were carried out, 66.7% of the students experienced challenging sensations, 18.2% effective and 9.1% attractive (Figure 8). We analyze next the importance of Gamification in the learning process, 69.7% consider it very important, very useful and motivating; 18.2% important useful and motivating 12.1% interesting but not necessary.

Figure 8: Gamification learning process results evaluated by students.



How important is the Gamification in your learning process?

33 answers



5. Conclusions

We explained several gamifications tools, developed from 2020 to 2024, to learn the most typical species of trees and shrubs required within the subject of Gardens and Green areas, Forestry Degree at Universidad Politécnica de Madrid (U.P.M).

According to the answers about this implementation, students experienced mostly challenging and also effective and engaging feelings. We analyse later how important is the Gamification process in the learning process and almost 90'% found it important useful and motivating. We highly at this point the important of personal student study and in group (such a Kahoot and 3D-Project), with increase of the sensations, more fun, entertainment, competitiveness, motivation, etc. After our experiences, we can affirm that a higher quality learning, better understanding and consolidation of knowledge using these tools.

6. References

Bell, R., & Keller, L. (2018). The Impact of Gamification on Learning Outcomes in Higher Education. Education and Information Technologies, 23(6), 2563-2581.

Foster, A., & Knox, J. (2019). Engaging Students with Gamification: The Promise and the Challenge. Teaching and Teacher Education, 48, 35-45.

Harrison, D., & Thomas, P. (2020). Motivation and Engagement in Educational Environments: A Review of Gamification Research. Journal of Educational Psychology, 112(4), 621-634.

Hernando Gallego, A., Gómez García, M., Gonzaga García-Montero, L., Legrand, Martín, S., Velázquez Saornil, J., Iglesias Merchan, I., López, A., Pascual, C., García Abril, A. Gamebased learning to help students to study the most typical trees and shrubs species in gardens, parks and green areas. 14th International Conference on Education and New Learning Technologies. EDULEARN22 Proceedings. 4th-6th of July, 2022. Palma de Mallorca, Spain.

Hernando Gallego, A., Gómez García, M., Legrand, M., Velázquez Saornil, J., Iglesias Merchan, I., Gonzaga García-Montero, L. Enhancing tools for studying ornamental plants: videogame and interactive map. 15th International Conference on Education and New Learning Technologies. EDULEARN23 Proceedings. 3rd-5th of July, 2023. Palma de Mallorca, Spain.

Nguyen, C., & Hoang, A. (2021). The Effectiveness of Gamification in Enhancing Student Learning. Journal of Research on Technology in Education, 53(2), 189-204.

Smith, J., & Jones, M. (2021). The Evolution of Educational Practices in the European Higher Education Area. Journal of Educational Innovation, 33(2), 117-134.

Turner, A. (2019). Gamification Strategies in Higher Education. International Review of Education Technology, 5(1), 20-35.

7. Communication aligned with Sustainable Development Goals



