

**This document describes the implementation of a GLP, along with the required functionalities from the authoring perspective. The goal is to get a clear understanding of:**

**A) How a lesson plan is translated into a GLP**

In general, a Lesson Plan is translated into a Gamified Lesson Plan when the activities it entails are adapted to the specific needs of the teachers and integrated into the 'slots' of a fitting Game Plot and deployed. The Beaconing Lesson Plan Archive should suggest appropriate Game Plots depending on the number of Quests/activities teachers might want to deploy, and allow them to edit the Plan through the Authoring Tool before deployment. The resulting GLP will be partially procedurally generated in its narrative. The example below provides one possible translation from the pedagogical contents into a gamified narrative.

**B) What features the authoring system should provide, so that the learning designer/teacher can achieve his/her goals**

Aside from the basic functionalities already established, the authoring system should provide:

- The possibility to define multiple minigames for a slot and students experience one at random.
- The possibility to define both passwords and success thresholds that have to be met for the student to be able to continue in the narrative.
- The possibility to run repeatedly Quests, and chains of Quests (as in, provide loops).
- Ideally, the possibility to change some or all of the narrative text to fit more closely the theme of a specific lesson path. In the included examples, some parts are within [parentheses], so that the teacher can more closely adapt the narrative to the theme of the lesson path. For example, [device] might mean a computer, a power generator, an aspect of the environment, [problem] might mean a glitch, a flood, an energy shortage, etc.

**C) What features a GLP should have in order to do this (upload activity, type of minigames, etc) - Example: Basic algebraic skills refresher course**

The present document showcases a slightly modified and simplified version of the "Save the Boss" narrative, as integrated with a slightly updated/unpacked version of the Basic algebraic skills Lesson Path.

Ideally, all GLPs should feature the possibility to upload content to provide evidence to be shared not only with the teacher but with other users of the same GLP, or, alternatively, the possibility for teacher to allow progress (e.g. through a password) only on the condition that student provides the evidence through more traditional means (e.g. in person or through normal email)

## **Quest 1 (previously defined as Mission 1 Quest 1)**

### **(Pre-existing knowledge test via a geolocation game)**

**Game Plot Element:** In this scene players gets introduced to the scenario. They have to go and meet the mentor for a rendezvous. They discover that there has been an emergency lockdown and needs to find keys to the security gates, triggering the first activity.

**Lesson Plan Content:** During the first tour of the school organized for the students, they are getting a quiz with activities containing questions to solve at each time they reach a certain place. There are 2 questions in each activity, one per operation.

Addition:  $12 + 39$ ;  $45,5 + 87,6$

Subtraction:  $45 - 21$ ;  $34,4 - 23,4$

Multiplication:  $11 \times 23$ ;  $24,2 \times 32,4$

Division:  $45 / 9$ ;  $45,6 / 5,3$

**Authoring requirements:** The ability to adapt the Location Based Activity to the specific context and components at hand.

**Activity Requirements:** The GPS/Beacon based treasure hunt via BEACONING, using the FOLLOW THE PATH type of Location Based Activity to answer all the quiz questions.

## **Quest 2 (previously defined as Mission 1 Quest 2)**

### **(Knowledge acquisition via documents)**

**Game Plot Element:** After passing the gates, players need to remember where is their rendezvous point with the mentor. They need to gather and read resources before continuing.

**Lesson Plan Content:** A refresher course is given and also some support material (paper, Internet). Ideally this is done outside of the classroom, as a kind of homework activity.

**Authoring requirements:** the teacher must be able to provide specific links to this external documentation, or to enable the platform to display it directly.

**Activity Requirements:** Students simply have to get through the content before proceeding with the GLP. The system must be able to check for this requirement, or otherwise enable the teacher to let students progress once they are through with it (e.g. by providing a password).

## **Quest 3 (previously defined as Mission 1 Quest 3)**

### **(Knowledge retention test via mini game part 1, additions)**

**Game Plot Element:** The mentor informs players that there is a [problem] and sends them to help a Non-Playable-Character (NPC) to fix it. This NPC is not present but the player can talk to NPCs who should know where he is.

**Lesson Plan Content:** Exercises are given to practice and reinforce as an automatism the refreshed knowledge. They can be done inside or (better, as homework) outside the classroom, through minigames.

EASY:  $25 + 14$ ;  $49 + 20$ ;  $58 + 63$ ;  $36 + 89$ ;  $48 + 55$ ;  $98 + 87$ ;  $65 + 23$ ;  $78 + 98$ ;  $155 + 244$ ;  $158 + 163$

MEDIUM:  $156 + 587$ ;  $896 + 135$ ;  $563 + 784$ ;  $456 + 789$ ;  $871 + 796$ ;  $1253 + 896$ ;  $5,6 + 10,4$ ;  $35,5 + 48,3$ ;  $56,8 + 87,9$ ;  $99,9 + 78,8$

HARD:  $1459 + 685$ ;  $1569 + 2687$ ;  $5478 + 7863$ ;  $25967 + 59687$ ;  $589763 + 54879$ ;  $12,26 + 56,41$ ;  $256,64 + 547,36$ ;  $1,236 + 2,5987$ ;  $5697,253 + 8976,4214$ ;  $97841,45 + 235,569$

**Authoring requirements:** The teacher must be able to select a specific minigame fitting the purpose and to specify to students the calculations used in the minigame

**Activity Requirements:** The students will play a minigame to test their knowledge. The minigames in question must be of the fill-the-gap type.

## Quest 4 (previously defined as Mission 1 Quest 3)

### (Knowledge retention test via mini game part 2, subtractions)

**Game Plot Element:** Once the NPC is found they go to the meeting room and AI invites the player to check how [a device] works.

**Lesson Plan Content:** Exercises are given to practice and reinforce as an automatism the refreshed knowledge. They can be done inside or (better, as homework) outside the classroom, through minigames. The minigames are of the fill-the-gap type.

EASY:  $25 - 14$ ;  $49 - 20$ ;  $58 - 63$ ;  $36 - 89$ ;  $48 - 55$ ;  $98 - 87$ ;  $65 - 23$ ;  $78 - 98$ ;  $155 - 244$ ;  $158 - 163$

MEDIUM:  $156 - 587$ ;  $896 - 135$ ;  $563 - 784$ ;  $456 - 789$ ;  $871 - 796$ ;  $1253 - 896$ ;  $5,6 - 10,4$ ;  $35,5 - 48,3$ ;  $56,8 - 87,9$ ;  $99,9 - 78,8$

HARD:  $1459 - 685$ ;  $1569 - 2687$ ;  $5478 - 7863$ ;  $25967 - 59687$ ;  $589763 - 54879$ ;  $12,26 - 56,41$ ;  $256,64 - 547,36$ ;  $1,236 - 2,5987$ ;  $5697,253 - 8976,4214$ ;  $97841,45 - 235,569$

**Authoring requirements:** The teacher must be able to select a specific minigame fitting the purpose and to specify to students the calculations used in the minigame

**Activity Requirements:** The students will play a minigame to test their knowledge. The minigames in question must be of the fill-the-gap type.

## Quest 5 (previously defined as Mission 1 Quest 3)

### (Knowledge retention test via mini game part 3, multiplications)

**Game Plot Element:** The NPC asks the player to go find the missing elements of the above [device] in various locations.

**Lesson Plan Content:** Exercises are given to practice and reinforce as an automatism the refreshed knowledge. They can be done inside or (better, as homework) outside the classroom, through minigames. The minigames are of the fill-the-gap type.

EASY:  $6 \times 9$ ;  $5 \times 12$ ;  $32 \times 3$ ;  $58 \times 7$ ;  $26 \times 41$ ;  $12 \times 23$ ;  $25 \times 34$ ;  $45 \times 87$ ;  $56 \times 58$ ;  $36 \times 98$

MEDIUM:  $45 \times 25$ ;  $58 \times 98$ ;  $77 \times 86$ ;  $56 \times -45$ ;  $87 \times -89$ ;  $12,5 \times 4$ ;  $32,2 \times 45$ ;  $9,5 \times 8,6$ ;  $12,5 \times 36,6$ ;  $89,3 \times 67,9$   
HARD:  $45 \times 897$ ;  $5364 \times 42$ ;  $457 \times 783$ ;  $4567 \times 2347$ ;  $-245 \times 654$ ;  $-789 \times -452$ ;  $23,45 \times 45,98$ ;  $7,832 \times 5,987$ ;  $489,8 \times 59,21$ ;  $957,8 \times 0,6541$

**Authoring requirements:** The teacher must be able to select a specific minigame fitting the purpose and to specify to students the calculations used in the minigame

**Activity Requirements:** The students will play a minigame to test their knowledge. The minigames in question must be of the fill-the-gap type.

## Quest 6 (previously defined as Mission 1 Quest 3)

### (Knowledge retention test via mini game part 3, divisions)

**Game Plot Element:** Once every parts are gathered the player needs to assemble them on the [device]

**Lesson Plan Content:** Exercises are given to practice and reinforce as an automatism the refreshed knowledge. They can be done inside or (better, as homework) outside the classroom, through minigames. The minigames are of the fill-the-gap type.

EASY:  $12 / 6$ ;  $56 / 2$ ;  $45 / 5$ ;  $88 / 4$ ;  $51 / 3$ ;  $125 / 5$ ;  $100 / 20$ ;  $88 / 22$ ;  $121 / 11$ ;  $490 / 35$

MEDIUM:  $120 / 6$ ;  $45 / 15$ ;  $41 / 4$ ;  $127 / 5$ ;  $-55 / 11$ ;  $256 / -16$ ;  $5640 / 32$ ;  $3590 / 16$ ;  $11624 / 200$ ;  $205 / 250$

HARD:  $98 / 7$ ;  $-65 / 3$ ;  $-47 / -5$ ;  $3 / 5$ ;  $25 / 31$ ;  $49 / 91$ ;  $456 / 87$ ;  $123 / 987$ ;  $65,87 / 4,5$ ;  $12,36 / 5,79$

**Authoring requirements:** The teacher must be able to select a specific minigame fitting the purpose and to specify to students the calculations used in the minigame

**Activity Requirements:** The students will play a minigame to test their knowledge. The minigames in question must be of the fill-the-gap type.

## Quest 7 (previously defined as Mission 2 Quest 1)

### (Pre-existing knowledge test via a mini game)

**Game Plot Element:** The [device] works again. The player needs to repurpose it for their use.

**Lesson Plan Content:** Basic questions about proportionality and cross-multiplication given through a minigame to test the pre-existing knowledge of the student. The minigames should be of the open question type. Ideally this is done outside of the classroom, as a kind of homework activity.

Question 1: What does proportionality mean?

Question 2: What is the rule of 3 (cross-multiplication) useful for?

Question 3: If 2 kg of fruits cost 10 euro, how much would be 1.5 kg?

Question 4: On a map, 2cm represents 15km. We measure a distance of 13.4 cm between two towns on the map. How far are they apart?

Question 5: 10 erasers cost 22 euros, how much 17 of them will cost?

Question 6: A pair of shoes costs 56 euros. There's a 30% discount. How much will you actually pay for them?

**Authoring requirements:** The teacher must be able to select a specific minigame fitting the purpose and to specify to students the calculations used in the minigame

**Activity Requirements:** The students will play a minigame to test their knowledge.

### **Quest 8 (previously defined as Mission 2 Quest 2) (Knowledge acquisition via documents)**

**Game Plot Element:** Everyone congratulates the players. However, the mentor is wondering why the [device] had missing elements and invites the player to investigate them, as it might be a case of sabotage.

**Lesson Plan Content:** A refresher course is given and also some support material (paper, Internet). Ideally this is done outside of the classroom, as a kind of homework activity.

**Authoring requirements:** the teacher must be able to provide specific links to this external documentation, or to enable the platform to display it directly.

**Activity Requirements:** Students simply have to get through the content before proceeding with the GLP. The system must be able to check for this requirement, or otherwise enable the teacher to let students progress once they are through with it (e.g. by providing a password).

### **Quest 9 (previously defined as Mission 2 Quest 3) (Knowledge retention test via mini game)**

**Game Plot Element:** An NPC and the player are back at the [device], which is now working. The NPC suggests that there might be a new [problem], but it's actually just an excuse to explore new tools.

**Lesson Plan Content:** A quiz is given to the students to test their knowledge of proportionality and cross-multiplication through a minigame of the multiple-choice questions kind. (Optional: the game starts when the student enters a supermarket. Ideally this is done outside of the classroom, as a kind of homework activity.

EASY (Choosing between two products only (the discount tag is indicated in parenthesis)):

8 and 9(-10%)

80 and 90 (-10%)

800 and 900 (-10%)

21 and 25 (-20%)

120 and 150 (-30%)

250 and 280 (-20%)

439 and 550 (-20%)

21 and 110 (-80%)

23 and 30 (-25%)

15 and 18 (-25%)

MEDIUM (Choosing between three products):

10 and 12(-10%) and 14(-20%)

20 and 24(-20%) and 28(-30%)

30 and 45(-35%) and 38(-25%)

40 and 78(-40%) and 95(-55%)

21(-10%) and 22(-14%) and 25(-24%)

25(-15%) and 26(-19%) and 25(-15%)

35(-14%) and 39(-23%) and 38(-24%)  
12(-23%) and 12.5(-25%) and 13(-27%)  
15(-31%) and 12(-12%) and 13(-18%)  
8(-13.5%) and 7.5(-12.5%) and 8.5(-19.5%)  
HARD (Choosing between four products):  
10 and 11.5(-10%) and 13.5(-20%) and 19.5(-45%)  
10(-14%) and 9.8(-13%) and 9.7(-12%) and 9.6(-11%)  
10(-26%) and 8(-10.5%) and 9.8(-22.6%) and 12(-37%)  
10(-37%) and 7.4(-11%) and 8.95(-23%) and 11.49(-41%)  
8.5(-48%) and 5(-10%) and 4.8(-2.4%) and 4.75(-4.5%)  
8.5(-6%) and 8.1(-1.1%) and 8.8(-8.6%) and 8.3(-3.5%)  
8.5(-9.6%) and 7.9(-3%) and 7.85(-2.5%) and 7.95(-4.3%)  
6.5(-21%) and 5.65(-9%) and 5.03(+1.57%) and 5.4(-4%)  
6.5(-3%) and 6(+1.9%) and 5.99(+2.4%) and 5.75(+5.5%)  
6.5(-11%) and 5.8(-0.4%) and 5.9(-4.7%) and 5.85(-2.37%)

**Authoring requirements:** to be able to specify a minigame for a slot, and a threshold for successful progress.

**Activity Requirements:** Any quiz minigame and a threshold function.

### **Quest 10 (previously defined as Mission 3 Quest 1)**

#### **(Pre-existing knowledge test via a mini game)**

**Game Plot Element:** NPCs give the players new tools, and suggest that they should also inspect other areas for [evidence] of sabotage.

**Lesson Plan Content:** Basic questions about divisibility rules given through a minigame to test the pre-existing knowledge of the student. The minigames should be of the open question type. Ideally this is done outside of the classroom, as a kind of homework activity.

Question 1: How can we spot easily if an integer can be divided by 2?

Question 2: How can we spot easily if an integer can be divided by 5?

Question 3: Do you know any other divisibility rules?

Question 4: Is 723 divisible by 3?

Question 5: Is 672 divisible by 7?

Question 6: Is 109816 divisible by 8?

Question 7: Is 2013 divisible by 9?

**Authoring requirements:** to be able to specify and link (or display) to the student instructions and suggestions toward building an improved, autonomously moving robot, and specify how to obtain evidence and allow for progress.

**Activity Requirements:** Ideally, students should be able to upload in a central storage photos/short videos of both the working improved robot and all the script that regulate its movements to be shared with other users of the same lesson path, and validated by the teachers. Alternatively, teachers will provide a password to progress in the GLP once they have ensured students have a working robot and scripts, whether in person or through documentations submitted via traditional means.

### **Quest 11 (previously defined as Mission 3 Quest 2)** **(Knowledge acquisition via documents)**

**Game Plot Element:** an NPC asks the player to check the [device] room. The player inspects it and finds some [evidence] of sabotage. It is suggested that the player brings it to be analysed.

**Lesson Plan Content:** A refresher course is given and also some support material (paper, Internet). Ideally this is done outside of the classroom, as a kind of homework activity.

**Authoring requirements:** the teacher must be able to provide specific links to this external documentation, or to enable the platform to display it directly.

**Activity Requirements:** Students simply have to get through the content before proceeding with the GLP. The system must be able to check for this requirement, or otherwise enable the teacher to let students progress once they are through with it (e.g. by providing a password).

### **Quest 12 (previously defined as Mission 3 Quest 3) (Knowledge retention test via mini game)**

**Game Plot Element:** Player work with an NPC to prepare analyses of the [evidence] of sabotage of the [device]

**Lesson Plan Content:** A quiz is given to the students to test their knowledge of divisibility rules through a minigame of the multiple-choice questions kind. Ideally this is done outside of the classroom, as a kind of homework activity.

EASY (Choosing between two lines only (the divisor is indicated in parenthesis)):

12 and 13 (2)

24 and 22 (3)

16 and 20 (5)

20 and 21 (10)

28 and 27 (3)

35 and 36 (3)

45 and 47 (9)

32 and 30 (8)

28 and 27 (7)

42 and 41 (7)

MEDIUM (Choosing between three lines):

62 and 64 and 66 (8)

107 and 108 and 109 (9)

187 and 188 and 189 (9)

168 and 169 and 170 (7)

215 and 216 and 217 (7)

198 and 199 and 200 (11)

252 and 253 and 254 (11)

593 and 594 and 595 (11)

232 and 233 and 234 (13)

325 and 326 and 327 (13)

HARD (Choosing between four lines):

764 and 765 and 766 and 767 (9)

615 and 616 and 617 and 618 (11)

517 and 508 and 519 and 507 (11)

182 and 185 and 168 and 194 (13)

621 and 624 and 612 and 614 (13)

475 and 485 and 480 and 490 (15)

520 and 525 and 530 and 535 (15)

503 and 504 and 512 and 513 (21)

668 and 653 and 650 and 672 (21)  
1561 and 1569 and 1573 and 1571 (143)

**Authoring requirements:** to be able to specify a minigame for a slot, and a threshold for successful progress.

**Activity Requirements:** Any quiz minigame and a threshold function.

### **Quest 13 (previously defined as Mission 4 Quest 1)**

#### **(Pre-existing knowledge test via a mini game)**

**Game Plot Element:** An NPC gives the result to the player and recommends him to make a search on the agency computer. However, the computer has been locked down during the alert and needs to be debugged.

**Lesson Plan Content:** Basic questions about prime decomposition and factorization given through a minigame to test the pre-existing knowledge of the student. The minigames should be of the open question type. Ideally this is done outside of the classroom, as a kind of homework activity.

Question 1: What is a prime number?

Question 2: What is a factorization?

Question 3: How can we decompose the number 18 in prime numbers?

Question 4: How can we decompose the number 50 in prime numbers?

Question 5: How can we decompose the number 120 in prime numbers?

Question 6: How can we decompose the number 121 in prime numbers?

**Authoring requirements:** The teacher must be able to select a specific minigame fitting the purpose and to specify to students the calculations used in the minigame

**Activity Requirements:** The students will play a minigame to test their knowledge.

### **Quest 14 (previously defined as Mission 4 Quest 2)**

#### **(Knowledge acquisition via documents)**

**Game Plot Element:** The player sees that there are too much results and needs to ask for the help of the team. Includes various interactions with NPCs.

**Lesson Plan Content:** A refresher course is given and also some support material (paper, Internet). Ideally this is done outside of the classroom, as a kind of homework activity.

**Authoring requirements:** the teacher must be able to provide specific links to this external documentation, or to enable the platform to display it directly.

**Activity Requirements:** Students simply have to get through the content before proceeding with the GLP. The system must be able to check for this requirement, or otherwise enable the teacher to let students progress once they are through with it (e.g. by providing a password).

### **Quest 15 (previously defined as Mission 4 Quest 3)**



### (Knowledge retention test via mini game)

**Game Plot Element:** Players can then talk again with all the team to retrieve the results and finally can be back to the computer to retrieve the search results. At the moment the results are revealed, everyone is surprised!

**Lesson Plan Content:** A quiz is given to the students to test their knowledge of prime decomposition and factorization through a minigame of the fill-the-gap questions kind. Ideally this is done outside of the classroom, as a kind of homework activity.

EASY:

12 ( $2*2*3$ )

25 ( $5*5$ )

36 ( $2*2*3*3$ )

41 (41)

52 ( $2*2*13$ )

78 ( $2*3*13$ )

79 (79)

85 ( $5*17$ )

99 ( $3*3*11$ )

120 ( $2*2*2*3*5$ )

MEDIUM:

130 ( $2*5*13$ )

156 ( $2*2*3*13$ )

189 ( $3*3*3*7$ )

210 ( $2*3*5*7$ )

224 ( $2*2*2*2*7$ )

259 ( $7*37$ )

288 ( $2*2*2*2*2*3*3$ )

312 ( $2*2*2*3*13$ )

366 ( $2*3*61$ )

380 ( $2*2*5*19$ )

HARD:

993 ( $3*331$ )

1001 ( $7*11*13$ )

1002 ( $2*3*167$ )

1015 ( $5*7*29$ )

1350 ( $2*3*3*3*5*5$ )

1701 ( $3*3*3*3*7$ )

1800 ( $2*2*2*3*3*5*5$ )

2916 ( $2*2*3*3*3*3*3*3$ )

3213 ( $3*3*3*7*17$ )

2431 ( $11*13*17$ )

**Authoring requirements:** to be able to specify a minigame for a slot, and a threshold for successful progress.

**Activity Requirements:** Any quiz minigame and a threshold function.