Let's Jazz: A Case Study on Teaching Music with Educational Escape Rooms

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Abstract: Escape rooms have been proven to be a functional game-based approach to teach a variety of subjects. Teachers as well as students are eager to play escape rooms in the classroom; field studies have demonstrated how escape games are a memorable activity with a high retention rate, especially if followed by a proper debriefing session, in which learnings emerged and are made consistent. In recent years literature on educational escape rooms has grown, yet there is little body of research on educational escape rooms on music education. In this paper we present an educational escape room about Afro-American music at the beginning of the past century. The players are asked to solve a murder case happened in the backstage of a jazz club in New Orleans. Such scenario gives the players/students the opportunity to "experience", within the escape room context, cultural and historical details and characteristics related to this musical genre. The puzzles within the escape room are formally related to jazz and Afro-American music, giving players/students the possibility to learn and have a "first-hand" experience with concepts that would otherwise remain purely theoretical within a normal classroom environment. Learning has been measured by the means of a 3-step test design: the pre-test was administered before playing the escape room, the first post-test was administered right after playing the escape room and before the debriefing, while the second post-test was administered two weeks after the debriefing phase. From a qualitative point of view the teacher has noticed high motivation while playing the game, with respect to a normal classroom activity. The quantitative results of the second post-test have shown students have retained many of the concepts presented within the escape room and this highlights the importance of a debriefing phase to consolidate learning after playing an educational escape room.

Keywords: Educational Escape Rooms, Music Education, Game-Based Learning

1. Introduction and background

Educational Escape Rooms (EERs) as a game-based learning activity have become popular in the past few years, especially in higher education. While many EERs have been studied in higher or adult education (Fotaris and Mastoras, 2019; Mijal et al., 2020; Veldkamp et al., 2020), only a limited body of work explores EERs in middle-school, primary school or kindergarten (Fotaris and Mastoras, 2019; Hod-Shemer and Dabush, 2020; Babazadeh and Frigerio, 2021).

Subject matter is also an issue. The popularity of platforms such as Breakout EDU (Rouse, 2017) has helped the spread of EERs in class, yet with a strong unbalance towards scientific disciplines, which apparently more easily fit within such a game framework. Indeed, there is still lack of research about the effectiveness of EERs for subjects such as music or the arts. Even Breakout EDU[1] only offers about five escape rooms that include "music", and only three of them are actually focusing on music and music theory.

Learning in an escape room – like in most game-based approaches – is motivating and memorable, but is often unaware, as the concept of stealth learning suggests (Sharp, 2012). While the fun and excitement of the game remain in the foreground, the acquisition of new knowledge and skills might fade to the background: mastering game-based learning requires experienced teachers (SchoolBreak, 2019). In most game-based learning approaches the debriefing phase is when the learning that took place during the game is addressed, elicited, commented and integrated with previous learning and in the overall instruction (Betrus and Botturi, 2010).

The goal of this paper is twofold: on the one hand, we present an EER in Music Education for lower secondary school students, contributing to the collection of evidence about the educational use of escape rooms in non-scientific disciplines and with young students; on the other, we designed a 3-step assessment in order to collect insights about the actual role of debriefing in the learning process.

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[1] Search performed on the Breakout EDU website the 27th of April 2022 at 15:39.

Our hypothesis was that before playing the EER students would have minimal knowledge on the subject matter. Right after playing the EER, we expect students to have only partially acquired new knowledge, which during the play phase is decontextualized from the overall learning path; eventually, after re-contextualizing it during the debriefing, we expect students to have consolidated their knowledge.

The paper is structured as follows: Section 2 describes the methodology: the design and rationale behind the EER, the experimental group, and describes how the experiment was designed. Section 3 describes the play phase and the debriefing phase of the EER. Section 4 presents the results of the tests and how the class performed before and after the debriefing, while Section 5 concludes the paper.

2. Methodology

The EER in Music Education presented in this paper was developed by a secondary school music teacher as a game-based learning activity to consolidate knowledge on jazz and Afro-American music. Given the lack of materials on the subject, the teacher decided to design his own EER following the Star Model (Botturi and Babazadeh 2020) as part of his Master Thesis on Music Education. On the one hand, the teacher was interested in studying the development of a EER on Music Education; on the other hand, attention was paid to the role of debriefing after having played an EER.

2.1 Designing the escape room

A typical EER spans over two class periods: one for playing and one for debriefing – not much time, so that the achievable learning objectives should be few and very clear. The overall instructional goal of the EER is to teach and consolidate knowledge on the topic of jazz and Afro-American music. To operationalize this goal, the teacher focused on the learning objectives listed in the official curriculum plan (DECS, 2015), in particular in its *"rappresentazioni, culture e percezioni"* ("representations, cultures, and perceptions") section. In particular, the teacher focused on treating characteristics and formal aspects of Afro-American music:

- Recognize instruments used in the context of Afro-American music
- Understanding the structure of the musical form and being able to describe it
- Classify styles and assign the correct social role to each of the observed styles (i.e., *Worksong* and *Spiritual*)
- Recognize the pentatonic scale and its extensive use in Afro-American music

Relevant content items were transformed into puzzles and organized in a *game-flow* for the players to explore in order to solve the EER. The narrative of the EER took the form of a thriller involving detective Brian Duke, who was tasked to find the culprit of a murder happened in a Jazz Club in New Orleans in the backstage of a concert. The EER starts with the players being asked to help the detective find the killer.
Section 3 illustrates in detail how the EER is played.

2.2 The experimental group

The study involved a second-year middle school class (ages 12-13) in the Italian-speaking part of Switzerland, composed by 13 females and 7 males pupils. The class is described as a heterogeneous group with different skill levels, which influenced how the subgroups were formed by the teacher during the play phase. Some of the students manifested mature and disciplined behaviour, while few others exhibited provocatory behaviour towards the teachers. During the play phase these difficult cases were grouped with quiet students in order to reduce the risk of misbehaviour.

At the beginning of the study the class had no prior knowledge of Afro-American music history and theory, and never had any lecture about Afro-American and jazz music, so that it was reasonable to expect rather low scores in the pre-test phase.

2.3 Experiment description

PHASE 1. Pre-test. To measure the impact of the EER on students' knowledge of Afro-American music, we decided to perform a pre-test to assess prior knowledge on the matter. Given the fact that there are no standardized tests on the subject matter, the pre-test was created by the teacher and included eight questions about jazz and blues, including their origins and their musical characteristics (instruments, musicians, structure, musical measures, etc.). The test was administered at the end of October 2021.

PHASE 2. Introduction to content. After PHASE 1 the teacher gave an introduction on the content, providing the students with the basic tools to understand what they were going to face during the EER in terms of subject matter. In particular, students were faced with micro-problem situations and derive conclusions which were analysed in class with the help of the teacher to contextualize the learning. This learning unit started in November 2021 and was concluded in January 2022.

PHASE 3. The educational escape room. In the first week of February 2022 students played the EER. Right after playing, the same test as the pre-test was administered to assess if students grasped some of the learning aspects of the EER and recall what they had seen in class before the debriefing.

PHASE 4. Debriefing. During the second half of February 2022 the teacher performed the EER debriefing with the students. This was done to contextualize what they have seen during the EER and solve misconceptions.

PHASE 5. Final assessment. Eventually, during the second week of March 2022 the second post-test was administered to measure how much the students understood and recalled after playing and after having received the EER debriefing. The post-test contained the same questions as the prior tests in a different order.

3. Let's Jazz

The EER foresees two groups that play at the same time; the groups have similar puzzles with different solutions and have to collaborate to find the solution of the final puzzle.
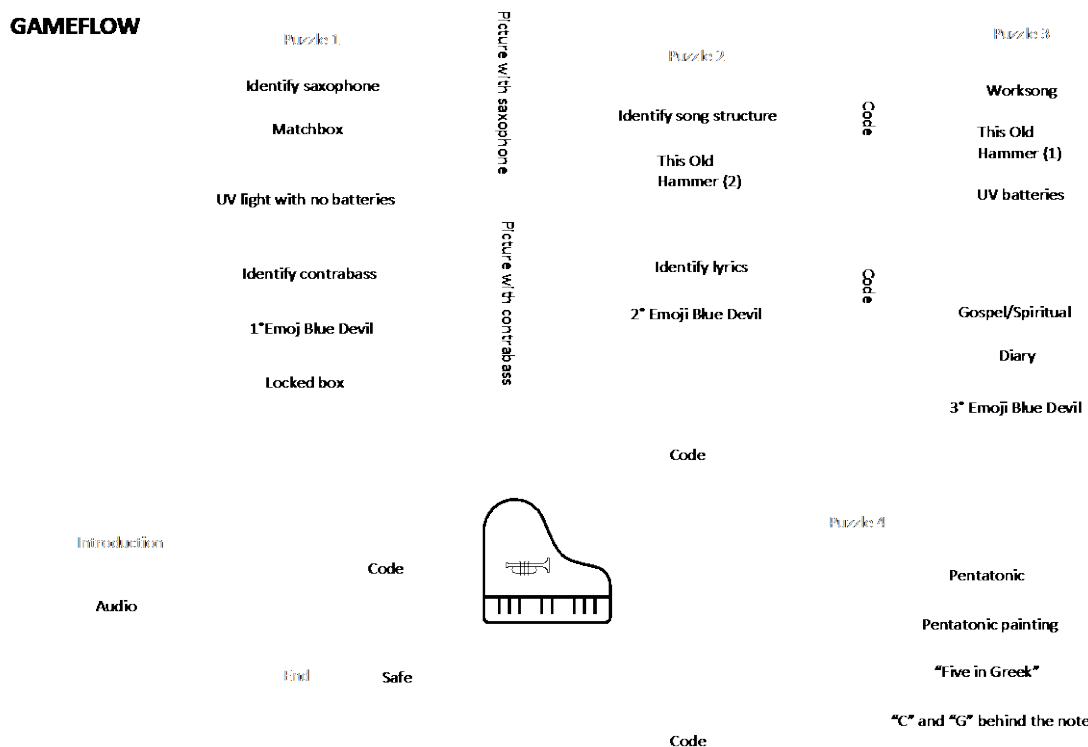
Figure 1: EER Game Flow.

Figure 1 shows the game flow (Botturi and Babazadeh 2020) of the EER. The grey boxes represent the puzzle areas. Each grey box contains smaller blue outlines which represent the puzzles the two sub-groups have to solve; in each outline the green box indicates the solution needed, while the orange boxes indicate elements or hints within the Puzzle area.

Puzzle 1. To access Puzzle 1 both groups have to find a missing disk "slice" and solve a musical puzzle (Figure 2). The solution found is a password to access a crypted PowerPoint presentation on which players can find an audio file (Puzzle 1). In Puzzle 1 players are asked to recognize an instrument being played within the PowerPoint

audio. The purpose of this Puzzle is to recognize musical values, musical instruments, and indirectly introduce faces and names of jazz music cornerstones such as John Coltrane and Miles Davis.

Figure 2: The solution to access Puzzle 1 for group B after the disk "slice" has been found.

During the resolution of Puzzle 1, Group A finds a matchbox with part of the solution of Puzzle 4 written with invisible ink, and a UV flashlight without batteries. During the resolution of Puzzle 1 Group B finds a locked box with no keys and an Emoji stained with lipstick behind which some lines of the lyrics of a famous Blues song are written.

Puzzle 2. To access Puzzle 2 both groups have to look for a picture portraying a detail of the instrument they recognised in Puzzle 1, behind which they can find the music sheet of a jazz song which will lead to Puzzle 2.

In Puzzle 2 group A finds a fragment of a music sheet of the work song *"This Old Hammer"*, behind which they can spot the word "Responsorial" (clue) in invisible ink. To solve this puzzle, players are asked to find the structure of the song. Group B finds another Emoji with lipstick stains; on its back they can read another fragment of the lyrics and are asked to find the name of the a famous Jazz rhythm. The solution for group A to access Puzzle 3 is "AABA", that is the formal structure of many jazz songs, while for group B is "SWING".

Puzzle 3. In Puzzle 3 group A finds the second fragment of the music sheet of the work song *"This Old Hammer"* and the batteries for the UV flashlight. Group B finds the third and last Emoji with the rest of the lyrics; Figure 3 shows the three Emojis players can find. Group A is now able to read the hidden words written with invisible ink on the matchbox and on the music sheet fragments giving access to Puzzle 4. Group B instead can recognize the lyrics and can derive the structure "AAB", which helps open the locked box found in Puzzle 1. In the box, players find the key to access Nole King secret diary, found in Puzzle 4 (Figure 4).

Figure 3: All three Emojis group B had to find.
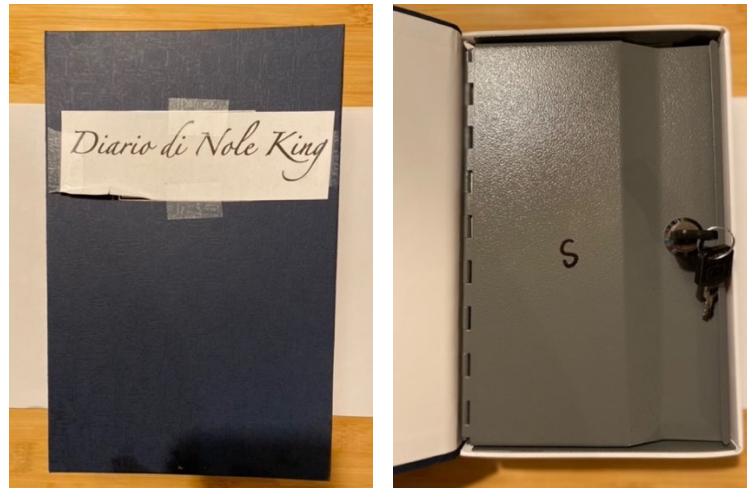
Figure 4: Nole King's secret diary.

Puzzle 4. To solve Puzzle 4 both groups have to put together the hints they found while solving the previous puzzles. Group A has obtained the last two letters of the combination, which were written on the matchbox (G A), while group B finds the letter "C" written with a lipstick behind a note in Nole King's diary. On the piano, available in the room, players are able to spot a lipstick stain on the "C" piano key. There are other hints for this puzzle, such as a painting with a pentatonic scale and a note hanging on the wall that says "five in Greek" ("*Pente*" reminding of pentatonic). By combining the C note and the last two letters, G and A, players realize these notes are part of the pentatonic scale, which they need to perform on the piano. The pentatonic scale becomes the key (the teacher acknowledge the correct key input sequence) to open the last box, a safe, which contains the narrative resolution of the EER: journal articles describing what happened that night at the Jazz Club.

3.1 The play phase

The idea of playing an escape room was well received and students were excited to play. For this study, in order to allow the active engagement of each student, during the play phase the class was divided in two groups which played two parallel instances of the EER. The two groups were further divided into the two sub-groups previously described (Group A and Group B) composed each by four or five students. The groups were created by the teacher in order to have balanced and heterogeneous groups, avoiding teams only composed by stronger or weaker students.

The game performance was very uneven: the teacher reported that while some groups managed to complete their path much earlier than expected, other groups found some puzzles difficult and could not get to the solution without help.

The teacher observed that, in the groups that worked better, a leader coordinated the work, so that every group member had his or her opportunity to propose and test a solution; in this way the puzzles were solved through collaboration. The groups which did not work well were lacking such a leader figure: every group member tried to brute force their solution without thinking and without communicating with the others. In some cases, there was just one member actively trying to solve the puzzles while the rest of the group simply watched, which resulted in frustration and discouragement.

These observations were confirmed by a game assessment survey that was administered right after the debriefing. The instrument included 6 items to be assessed on a 5-point Likert scale ranging from "Completely disagree" (with a value of zero) to "Completely agree" (with a value of 5). The items included self-evaluation and soft skills assessment on how the players performed in a team, if they found it easy to follow instructions, and if their mistakes during puzzle resolutions were understood (Table 1).

Table 1: Game assessment test questions

#	Statement
1	I know how to cooperate effectively as a member of a team
2	I remember the important parts of the Escape Room
3	I find it easy to follow instructions or take orders from others
4	I had fun playing the Escape Room
5	I understood the instructions of the teacher
6	I understood my mistakes
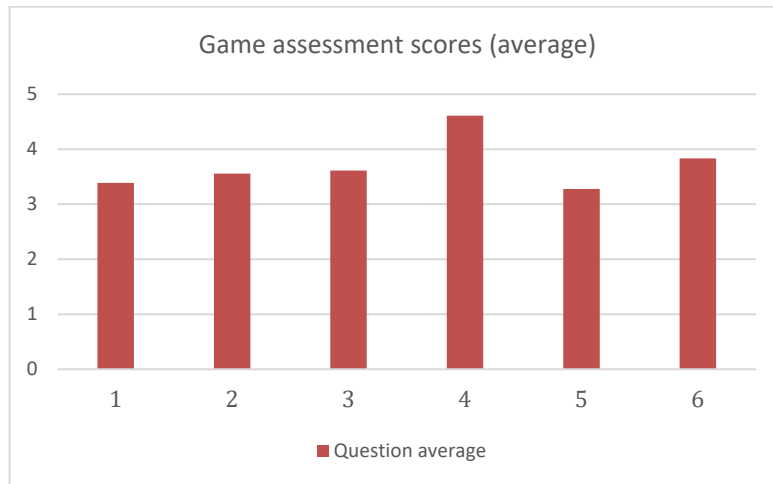
Figure 5: Weighted average of the answers for the game assessment survey

Figure 5 shows the weighted average of the answers for each of the six questions administered with the game assessment survey. As we can see most of the students enjoyed playing the EER, confirming the observation of the teacher during the play phase and the debriefing phase. Interestingly enough, students seem to have understood their mistakes during the play session, confirming the importance of the debriefing and the consolidation of their subject matter competencies. On the other hand, the instructions of the teacher before the play phase seemed not to be so clear for some students (item number 5), suggesting a better introduction of the play phase could be done by the teacher.

3.2 The debriefing phase

During the study, the debriefing phase was very important to consolidate, contextualise, and conceptualise the learning. It was structured in three steps.

STEP 1. EXPRESSING FEELINGS. At first, students had the chance to express their feelings about the gameplay. Everybody had a positive and memorable experience, even though some students felt stressed and frustrated during some puzzles, especially the students which did not have a collaborative group. As expected, students were excited mostly because of the collaborative aspect of the experience, rather than for the possibility to learn something new through the game. Indeed, as such game-based learning experiences diverge from standard classroom learning, students have the chance to enjoy a different learning mode while playing with their peers. This was true especially for those who collaborated well during the game phase and managed to solve the puzzles with their groups; students in non-collaborative groups reported that the experience was not as positive but memorable and fun nonetheless.

STEP 2. CONCEPTUALIZING LEARNING. After the first unstructured step, the teacher started conceptualizing the learning, asking the students how they solved the various puzzles, and reframing with some misconceptions that arose. The teacher focused on some details of puzzles that most of the students overlooked, for example the characters portrayed on the disks in Puzzle 1. In fact, only few students paid attention at the musicians on the disks and retained that information. This also arose in the first post-test, where students, even though having played the EER, had difficulties naming three famous jazz musicians. During this phase the teacher went into details as who these musicians were and how they become cornerstones of this musical genre. The same happened for the definition of terms such as "riff", which was still unclear.

STEP 3. FORMALIZING LEARNINGS. After analysing each puzzle, the class wrote a summary of the EER where they identified various definitions for each topic in the subject. This structured phase helped the students to keep track of what has been seen and recap the major aspects of the subject.

Overall, the teacher observed that the debriefing helped contextualising what has been experienced during the EER and this was reflected in the second post-test, where students demonstrated that the concepts were indeed solidified and better understood. The following Section presents the test results to support this claim.

4. Results

Each of the 3 tests had a maximum of 39 points that could be scored by replying correctly to all eight questions. Each question had a different maximum score, from one to five points, depending on the difficulty of the question and the expected length of the answer. Table 2 shows how the points were computed for each question.

Table 2: Evaluation rubric for students answers on the tests

Answer	Scored points (%)
Complete and correct answer	100%
Correct and non-complete answer	75%
Partial answer	50%
Incorrect answer	25%
No answer	0%

By the means of the evaluation rubric in Table 2 we were able to assign each student to a class (low/medium/high) for each of the tests (Test 1: pre-test; Test 2: post-test right after the EER; Test 3: post-test after the debriefing). The "Class" column represents the range of scores in the test: the "LOW" label represents a score lower than 50% of the maximum points achievable, the "MEDIUM" label corresponds to a score within the range of 51% and 70%, while the "HIGH" label represents a score higher than 71%.
Table 3 shows the scores in percentage of the tests and the average score per group category.

Table 3: Average and results of the pre-test and the two post-tests. Two students did not attend the session in which the Test 3 was administered.

| Class	Test 1 (%)	Test 2 (%)	Test 3 (%)
HIGH	0	25	66
MEDIUM	0	45	34
LOW	100	30	0
Average score	9.50	58.35	73.72

By confronting the pre-test and the first post-test, and the first post-test and the second post-test, we can immediately see a performance improvement for all students (with the exception of one student which underperformed in the second post-test with respect to the first post-test). The percentage of the "LOW" class shifted from 100% in the pre-test to 30% in the first post-test. Most of the class shifted towards the "MEDIUM" range while some students managed to achieve to fit within the "HIGH" score range (25%).

This suggests that the introduction on the concepts plus the consolidation through the EER had a positive effect on the subject matter competencies. Even more so if we take a look at the difference between the first post-test and the second post-test. In the second post-test we see that all the students managed to achieve a score above the 50% of the total points (no students appear in the "LOW" class). 34% of the students managed to fit within the "MEDIUM" range while most of the class, 66%, managed to achieve a score that fit within the "HIGH" group. The change in the average score (last row of Table 3) summarizes the growth of the class in terms of subject knowledge. The average is computed after having normalized the scores to a scale from 0 to 100 for better clarity.

The Sankey chart in Figure 6 depicts the evolution of the scores in the three tests. The three colours represent the test scores classes: red represents the "LOW" class, yellow represents the "MEDIUM" class, while green represents the "HIGH" class. The number besides the labels in the diagram indicate the test, "1" for the pre-test, "2" for the first post-test, and "3" for the second post-test.

The leftmost vertical line shows that all the class got a score less than 50% during the pre-test, when the class still had to be introduced the topic. The middle vertical line shows the results of the first post-test, right after the EER has been played. Some of the students managed to retain some information after the play phase, with only six students achieving less than 50% ("LOW" class) and five students scoring more than 71% ("HIGH" class). After the debriefing, students managed to contextualise the contents of the escape room and clarify some doubts, this is shown on the results of the second post-test, rightmost vertical line, where no student scored less than 50% and six students remained in the range 51%-70%. The two missing students are shown as "N/A" on the diagram.
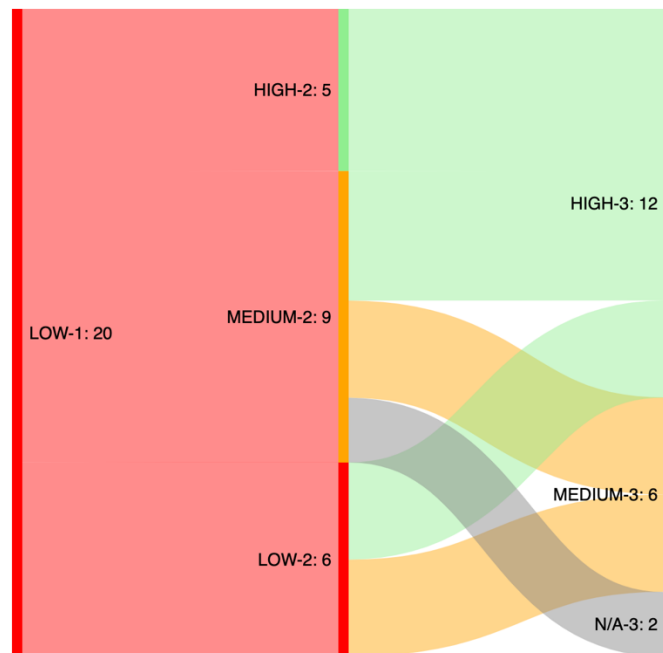
**Figure 6:** Sankey chart showing the evolution of the scores during the three tests

Figure 7 shows the mean delta variation and standard deviation delta variation across the three tests. We computed the difference of the normalized scores for each student from pre-test to the first post-test ("post-test 1"), from the first post-test to the second post-test ("post-test 2"), and from the pre-test to the second post-test. Then we computed the mean and the standard deviation of the result.

For every student the difference between the pre-test and the first post-test has a positive delta, meaning that on average all the students scored better in the first post-test than in the pre-test. This comes as no surprise as the pre-test was done right before any introduction of the subject. The same observation applies to the delta between the first post-test and the second post-test. Except for one student, everyone else managed to obtain a positive delta, thus improving their score from the first post-test.

The delta between the pre-test and the second post-test suggests that there was an increase in subject knowledge. Students managed to learn from the introductory lectures and if on the one hand the play phase helped with self-evaluation by testing their knowledge while discovering something new, on the other the debriefing phase conceptualized and contextualized this learning which was then integrated.

The teacher described the high retention rate as a primer for this class, which motivated the application of such game-based learning activity in the future.
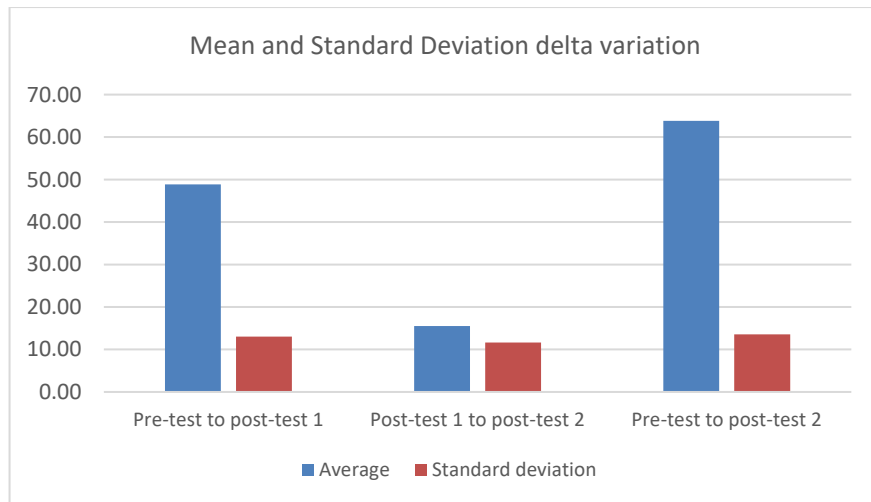
Figure 7: Mean and standard deviation of the delta across the tests.

5. Conclusion

In this paper we presented an educational escape room (EER) in Music Education for lower secondary school students about jazz and Afro-American music. This work contributes to the collection of evidence about the educational use of escape rooms in non-scientific disciplines and in lower secondary education.

Students were presented with a pre-test to assess their knowledge on the subject matter, then were introduced by the teacher on the subject by the means of micro-problem situations. Students played the EER and were administered a first post-test to assess their knowledge after the subject introduction and the play phase. After having debriefed the play phase, the teacher conducted a debriefing and administered a second post-test to assess if there are differences in student comprehension and understanding of the subject.

Quantitative results suggest that the introduction of the subject and the play phase helped most of the students improve their knowledge, while the debriefing contextualized and consolidated it even more, improving the scores of the students on the second post-test. In fact, most of the students (66%) managed to achieve more than 71% of the total score in the second post-test, while only 25% of the students managed to achieve such score in the first post-test.

Qualitative results derived from teacher observations confirm that EER are fun and enjoyable for students, which find such game-based learning activities memorable with respect to standard classroom activities. Quantitative results provide insights on how students perceived the experience, suggesting it also helped improve soft skills, and on the importance of the debriefing phase.

Unfortunately, this study was conducted on only one class. Further research could use an experimental design, and could better study the motivational and learning impact of the EER in Music Education and in lower secondary education. We expect the double-post-test design proposed in this study to generate relevant evidence to shed light on the learning processes associated with ER-based learning.

A focus on student profiles might also be helpful to identify the characteristics that makes students more prone and ready to learn from escape games at school.

Acknowledgements

References

Babazadeh, M., & Frigerio, M. F. (2021, September). Enhancing Problem-Solving Skills with Educational Escape Rooms: a Middle School Case Study. In *Proceedings of the European Conference on Games Based Learning* (pp. 53-62).

Betrus, A., and Botturi, L. (2010) "Principles of using simulations and games for teaching". In A. Hirumi (ed.), Playing Games in Schools: Engaging Learners through Interactive Entertainment, International Society for Technology in Education, pp 33–55.

Botturi, L. and Babazadeh, M. (2020) "Designing Educational Escape Rooms: Validating the Star Model", International Journal of Serious Games, Fall, Vol 7, No. 3, pp 41–57.

Dipartimento Educazione Cultura e Sport - DECS (2015), *Piano di studio della scuola dell'obbligo ticinese.* Bellinzona: Repubblica e Cantone Ticino, Dipartimento dell'educazione, della cultura e dello sport, Divisione della scuola.

Fotaris, P., & Mastoras, T. (2019, October). Escape rooms for learning: A systematic review. In *Proceedings of the European Conference on Games Based Learning* (pp. 235-243).

Hod-Shemer, O. & Dabush, E. (2020, October). A Kindergarten Educational Escape Room - Insights. In *Proceedings of the EARLI SIG 5 2020 International Virtual Academic Event Early Childhood Education: Growing Up in Dynamic and Changing Times*. 10.13140/RG.2.2.12783.87208.

Mijal, M. & Cieśla, M. & Gromadzka, M. (2020). Escape room as an adult education tool. *Homo Ludens.* 163-178. 10.14746/HL.2020.13.10.

Rouse, W.L. (2017) "Lessons learned while escaping from a zombie: designing a breakout edu game", *The History Teacher*, Vol. 5, No. 4.

SchoolBreak (2019). Using Escape Rooms in Teaching. SchoolBreak Project Handbook. http://www.school-break.eu/handbooks-videos

Sharp, L. A. (2012). Stealth learning: Unexpected learning opportunities through games. Journal of Instructional Research, 1, 42-48.

Veldkamp, A. & Grint, L. & Knippels, M. & van Joolingen, W.. (2020, November). Escape education: A systematic review on escape rooms in education. *Educational Research Review. 31*. 100364. 10.1016/j.edurev.2020.100364.