

Supplementary File S2

This appendix examines the punctuations assigned to each chosen game applying the GEB metric. First, the narrative, the gameplay and the represented illnesses are explained. Secondly, one of the authors assesses every score in a table explaining in each section the valued feature and the given punctuation for the found characteristics and then, evaluates the general results. From this analysis, some improvements which could be applied to the game are proposed to increase its educational capacity. At last, the volunteer surveys outcomes are reviewed in comparison to the author's test.

Video game: Sym

Sym is a puzzle platform game released in 2015 which explores social anxiety disorder. Players take on the role of Josh, a teenage boy who has to cross through 44 levels of black and white mazes as Figure 6 shows. The videogame uses a monochromatic and abstract art design to reflect social anxiety pressures and uncertainties. The player has to move between the real world and the one the main character has created to avoid his fears which appear as monsters, big eyes, shadows and blades. While the user progress, different messages are shown in the background expressing usual thoughts and behaviors caused by this illness. The final levels regard how Josh learns to handle these feelings and how he can help other people experiencing the same.

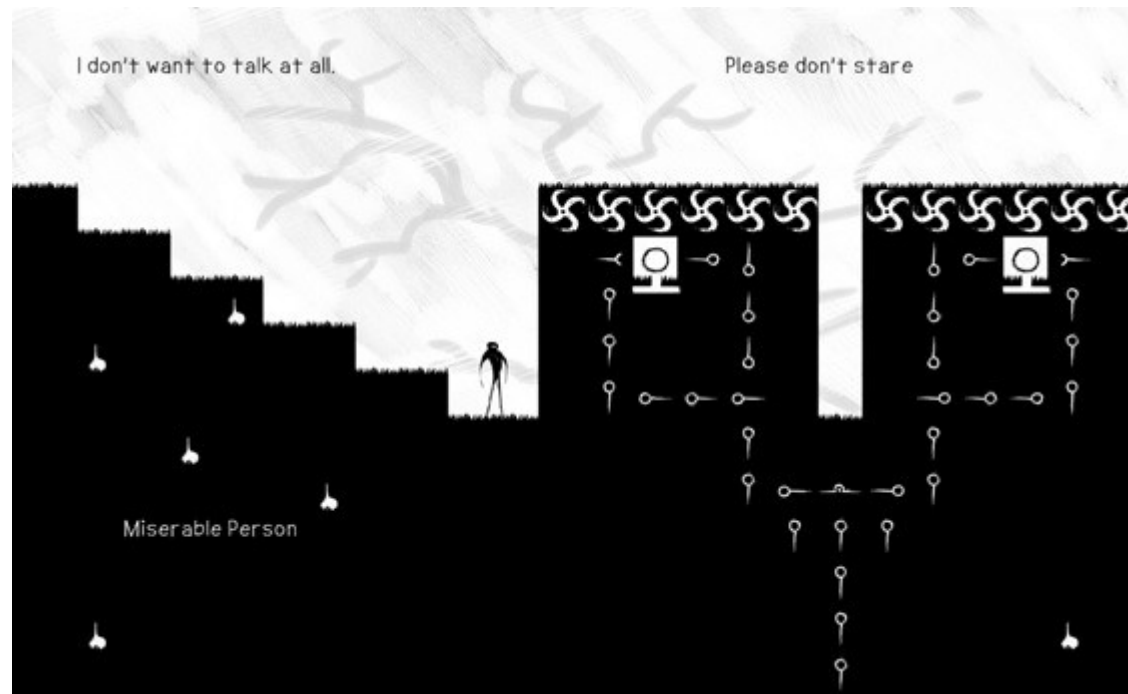


Figure S1. Capture of Sym game

Author's analysis:

Table S1. GEB Model application to Sym game

| Section | Feature | Punctuation | Evaluation |
|---------------|----------------|-------------|---|
| GAME OVERVIEW | Game Mechanics | 5 | The video game is structured in levels of platforms through which the player must advance to complete the experience. However, the only rewards Sym offers are videos for completing certain phases. Therefore, the mechanics that create the fantasy are considered to be limited to the relevant actions. |
| | Game Dynamics | 8 | Sym bases all the gameplay on progressively increasing the difficulty of the platforms. The player needs to find a strategy in each level and explore the space to overcome it. Though, there are no characters or objects to interact with, so the total score is not assigned. |

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| | Aesthetics | 8 | The aesthetic intention of the video game is to recreate a space that emulates anxiety, with feelings of apprehension and sadness. This feature is quite accomplished with the graphics and music feeding a constant tension throughout the experience. |
| | Technology & User Experience | 8 | Controls are easy to learn, besides give the option of mastering them with experience and choosing tactics, although not in the long term. Likewise, the interface is pleasant throughout the game. |
| EDUCATIONAL CONTENT | Instructional Strategies | 5 | The game does not require you to acquire some knowledge about the represented anxiety. Nevertheless, platforms genre is not associated at all with learning and the experience is more focused on playful messages than educational ones. |
| | Backstory & Production | 1 | Plot is linked to the learning content by describing the feelings related to anxiety. However, the narrative does not widely explain it nor does give the possibility to choose its development or end at any time. |
| | Realism | 1 | Sym's aesthetic is based on the abstraction of the feelings that anxiety provokes for what is unrealistic. The experience does not give options to customize the avatar nor do the characters acquire many expressions in the game. |
| | AI & Adaptivity | 1 | Sym does not offer any possibility to adapt the difficulty to the player. In any case, the scenario does offer guidance when new elements appear or when there are different paths to continue. |
| | Interaction | 5 | The game includes a simple tutorial as only the directional arrows are used. The interaction is easy to understand and control, moreover, it becomes progressively more complicated. This experience does not include any type of communication with other players. |
| | Feedback & Debriefing | 1 | Interactions in the game offer immediate rewards as the player overcome the levels. This experience is not intended to carry out an information session or have a support teacher. |
| OVERALL BALANCE | Learning & Fun Balance | 8 | Sym offers a progressive difficulty, with the educational content well distributed in the game time. It's fun to play through the entire experience, which provides a lot of insight into the intrusive thoughts that social anxiety causes. |
| | Can Learn vs. Must Learn | 0 | The game does not make learning about social anxiety experiences mandatory in any way. There is also no supplemental content that can be accessed. |

Analyzing Sym by the proposed metrics results in an Overall Rating of 51/100, a bare pass score. Nevertheless, its punctuations are really unbalanced as Table 1 shows. The particular strength of this video game is the gameplay, rating 29 of 40. Sym is a pretty enjoyable experience offering levels, exploration possibilities and difficulty progression to engage the player. The audiovisual elements are very motivating and the interface is simple, facilitating pleasant interactions. On the other hand, the Educational Overview gets an insufficient 14/40 score. The main handicap is that the game does not require any learning competences to complete it. Furthermore, there isn't a realistic plot which

introduces the educational content and it doesn't support or adapt for the player. Regarding the Overall Balance, the 8 score is totally uneven. The game engages the player through progressive learning and fun contents but it doesn't differentiate between mandatory and complementary matters.

In accordance to the results, some changes in a platform game like Sym will improve its educational aim. Concerning the gameplay, it is a good game which may include more items and rewards while exploring the levels to raise the mechanics score. The most necessary changes are related to the educational content introduction in the game. The backstory should vary so each player could customize the main character with their own attributes to play as a personal experience. Furthermore, the progress between levels should allow different paths based on the social anxiety learning so players couldn't move forward unless they understand this illness. In this way the experience will be more realistic and adapted for the player, ensuring the acquisition of the proposed knowledge. Additionally, some complementary information about social anxiety consequences should be included along with the explorative actions so each player can learn more if interested.

Volunteer's review:

The surveys general average gives 44.92 points to Sym, lower than the author's 51, so it would not pass as an educational game. This difference is mainly due to the Game Overview because Dynamics, Aesthetics and Technology & UE have decreased scores. The found issues in playability can be explained thanks to the personal experience responses. Sym is a platform game that has been difficult for several of the users, so it is understandable that their perception of the dynamics which create challenge and the interaction with the interface was negative. Also, many testers have described it as dark, which has resulted in a lower Aesthetics rating.

The Educational Content mean is 14.58, almost the same as the author's 14. Each feature averages are quite similar too, with the only notable contrast of Backstory & Production, which is 1.25 points higher than the expert's punctuation. This characteristic measures the plot's interest and its relationship with the learning content, as well as the player's ability to choose its development. Most of the users did not finish the game and for that reason they may have valued in a more positive way this plot which does not give choices and that is somewhat repetitive.

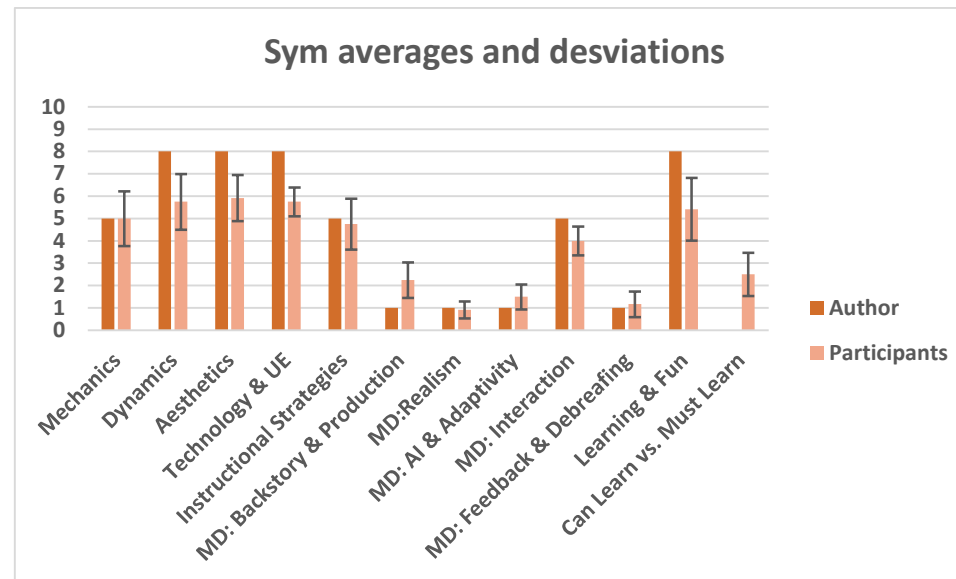


Figure S2. Sym's comparison of results between the author and the participants.

Overall Balance average is 7.92, almost equal to the 8 given by the author. However, the Learning & Fun average is smaller, perhaps due to the difficulty encountered in the gameplay, besides some users rated Can Learn vs. Must Learn as acceptable, probably for the same reason above: they did not complete the game to see the lack of possibilities. Regarding the total standard deviation, it is 9.28, which out of 100 is not very high. Anyway, the game failed for 10 of the 12 respondents, indicating they see Sym's weaknesses, mainly in its learning content and balance.

Video game: Actual Sunlight

Actual Sunlight is a graphic adventure game released in 2015 regarding depression and suicide. The interactive story presents Evan Winter, a man in his thirties who hates himself and is trapped in a life he can't stand. This one was made using a Role Playing Game (RPG) maker, a program with simple tools to develop games, so the design is as basic as Figure 7 shows, and thus the player simply moves the main character through different places. The interface allows to explore and interact with various items and people, thereby displaying Evan's inner thoughts as Figure 8 shows. By this way, the user discovers how is Evan day-to-day routine and how is affected by the depression he suffers. Actual Sunlight tells the source of the main character's emotions and the process by which he gets stuck with these. The story shows this loop worsening until Evan can't bear it anymore and kills himself.



Figure S3. Capture of Actual Sunlight game

Author's analysis:

Table S2. GEB Model application to Actual Sunlight game.

| Section | Feature | Punctuation | Evaluation |
|---------------------|------------------------------|-------------|---|
| GAME OVERVIEW | Game Mechanics | 2 | Actual Sunlight does not offer any mechanics that present a challenge such as missions or skills. Though, there are answers and images that are discovered in the exploration and interaction with objects and characters which feed the fantasy. |
| | Game Dynamics | 5 | Controls are basic and the experience does not increase the difficulty or introduce possible strategies. However, the relevant actions of the game are based on interacting with objects and characters to advance and find more information. |
| | Aesthetics | 5 | The game's intention is to make the player empathize with the emotions that depression creates. Although the aesthetics are based on pixel art and the audio is simple, they do manage to generate these emotions in a moderate way. |
| | Technology & User Experience | 5 | Interactions are simple, giving immediate control from the beginning, although these do not get complicated over time or allow the player to choose tactics or strategies. The interface aesthetics are pleasant throughout the experience. |
| EDUCATIONAL CONTENT | Instructional Strategies | 2 | Actual Sunlight does not require the player to learn certain knowledge to complete the game in any way. Graphic adventures are not associated with learning, although the game warns of the subject since the beginning. The playful and educational messages are balanced. |
| | Backstory & Production | 3 | Plot is very interesting, highlighting the feelings of a person on the verge of suicide. All educational content is involved in the story. Nevertheless, the narrative does not offer many options to choose the development of the story since it has a fixed ending. |
| | Realism | 3 | Even if the game aesthetic is based on pixel art, the representations of the situations are very realistic. The experience does not offer any type of avatar customization. It uses natural language and the characters expressions are shown even if there are no voices. |
| | AI & Adaptivity | 1 | The game has a very simple interface in which control is not difficult at any time so it does not need any adaptability. Non-player characters' reactions change as the story unfolds. |
| | Interaction | 3 | Interactions are simple and easy to understand, but these do not get progressively complicated in the game. Likewise, the game does not offer the option to interact with other people. |
| | Feedback & Debriefing | 1 | Interactions with characters and objects provide information in the game which is understood as the progress of the story. This experience is not intended to carry out an information session or have a support teacher. |
| OVERALL BALANCE | Learning & Fun Balance | 8 | Actual Sunlight is an engaging experience that encourages the player to continue it to the end. The educational content on depression and suicide is well distributed throughout the game time, although it is not related to the progression of the difficulty. |

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| | Can Learn vs. Must Learn | 10 | The game offers mandatory and exploratory interactions in which the required and complementary knowledge are equally distributed. The most important notions about suicide are found in the relevant actions of the game and the complementary ones in the exploration. |
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Applying the proposed metrics to Actual Sunlight results in an Overall Rating of 48/100, shown in Table 2, so the game does not pass as a good educational experience. The main reason for this is the game's excessive simplicity. The gameplay merely passes as acceptable with a 17/40 score. The aesthetics and interface are nice but don't evoke strong emotions, beside the lack of interaction tactics or progression. Along with this deficit, there is no feeling of challenge for the player because the game doesn't have missions, rewards or the need to demonstrate certain skills. The Educational Overview doesn't score well either with only 13 points. The story has the ability to teach how a suicidal person feels but it alerts from the beginning about the subject. Following the instructional strategies guidelines this approach can make the player reluctant to the learning. Moreover, the game doesn't test if the knowledge is comprehended and it is not adapted to the user's actions. Nevertheless, the Overall Balance is a really high 18 score. This contrast is due to the well distributed contents trough the exploration and gameplay and its progression within the story. This means the outcome may be educational if the player is personally motivated to complete the experience. This game responds to an important social matter and includes significant knowledge of suicidal and depressive thoughts. The main changes needed to its educational purpose are related with its gameplay. Concerning the aesthetics aspects, the game has an untapped potential improving the audiovisual elements regarding the strong emotions evoked by depression. Furthermore, the mechanics and dynamics layers could benefit from the usual RPG features as missions, skills, items and rewards which associated with leveling the character will create a strategy. These additions will also increase educational aspects providing better Backstory, Realism, Adaptivity and Interaction. Finally, to check the player's learning the game should include different choices which could change the plot outcome. Users could demonstrate how well they have understood the main character issues so he could shift his ending.

Volunteer's review:

For Actual Sunlight the overall mean is smaller than the expert's total, 42.08 versus 48. The section with the higher difference is Overall Balance, the respondents give 11.58 and the author scores 18. Generally, users have described the game as a repetitive and simple experience, which is why the Learning & Fun punctuation is lower. In addition, they also found few gameplay options and too much text, even if the theme was interesting. Therefore, although Can Learn vs. Must learn is higher this feature still not reach the level granted by the expert.

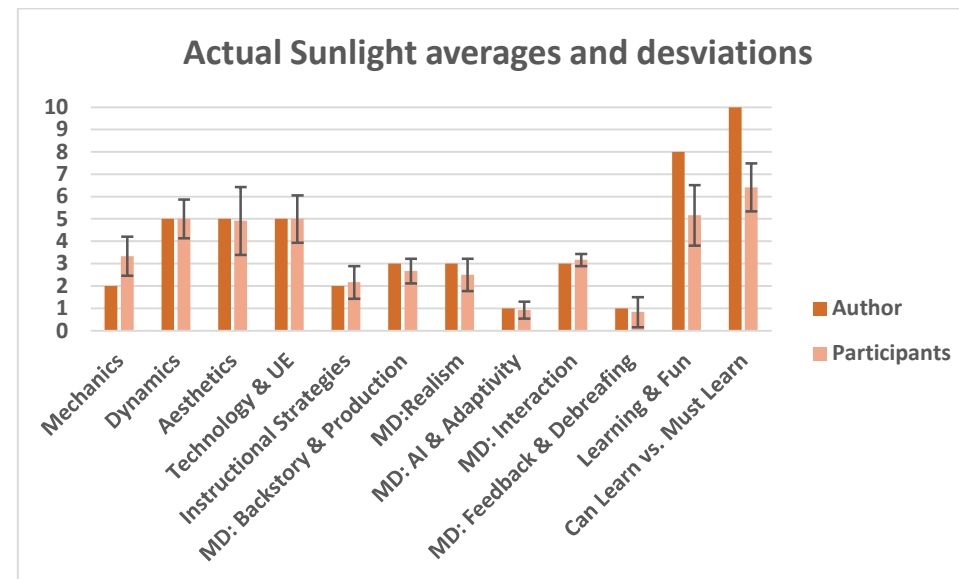


Figure S4. Actual Sunlight's comparison of results between the author and the participants.

The Game Overview score is slightly higher in the surveys, 1.25 points more than the author's. The highlighted difference comes from Mechanics as several respondents thought the items and responses given in the experience are at least acceptable. Moreover, a deviation of 3.04 does stand out in Aesthetics, probably due to the retro pixel art graphics

which can be very stimulating or very simple depending on the player's tastes. Regarding Educational Content, the characteristics averages are pretty similar to the expert's scores, as well as the total, 12.25 from the surveys and 13 from the author.

The deviation of the total scores is the highest in this game. There are 4 people who do approve Actual Sunlight as an educational experience in contrast with 8 others who give it an even lower score than the author's. The people who endorse the game correspond with those who value the gameplay more because they like graphic adventure games.

Video game: Neverending Nightmares

Neverending Nightmares is a survival horror game released in 2014 which presents struggles related with obsessive-compulsive disorder and depression. The story is about a man named Thomas who wakes up from one nightmare to another throughout all the experience. The game design uses a hand-drawn line art for the characters and venues as Figure 8 shows. The interface is very simple as the player just has to move Thomas through space and interact with the colored items. Every nightmare becomes progressively worse including creepy objects, scenes and monsters. These situations represent the intrusive thoughts that can be caused by depressive and obsessive-compulsive disorders as self-harm, social phobias and future fears. Neverending Nightmares has three different outcomes, in which various issues are performed, depending on the player's choices and hence allows to explore these alternative endings.



Figure S5. Capture of Neverending Nightmares game

Author's analysis:

Table S3. GEB Model application to Neverending Nightmares game

| Section | Feature | Punctuation | Evaluation |
|---------------|----------------|-------------|---|
| GAME OVERVIEW | Game Mechanics | 2 | The game is divided into levels, with the sole objective of advancing through the scene and survive. The only rewards given for completing the phases are some images of the main character. Therefore, these mechanics are hardly found in the relevant actions. |
| | Game Dynamics | 10 | In all the actions of the game there are patterns, tactics and a progressive difficulty that the player must assimilate to advance. Likewise, the experience gives possibilities of exploration and interaction with objects that create a lot of curiosity. |

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| | Aesthetics | 10 | In addition to representing depression and obsessive-compulsive disorder, Neverending Nightmares is a survival horror. The aesthetics and music are developed to keep the player in constant tension and generate emotions of fear, drama and surprise. |
| | Technology & User Experience | 5 | The interface is simple and gives a feeling of immediate control, although it does not get complicated over time. A nice aesthetic is also maintained throughout the game. It only gives a few short-term options on how to survive enemies. |
| EDUCATIONAL CONTENT | Instructional Strategies | 2 | The game does not include any tests for which you need to learn some knowledge. The survival horror genre is not associated with learning in any way. Playful messages are more numerous than the educational ones. |
| | Backstory & Production | 3 | Neverending Nightmares plot is interesting and keeps the unknown constant for the player. The educational content is quite integrated into the narrative. The game offers exploration options and three possible endings. |
| | Realism | 3 | Within its abstract style, the representations of depression and obsessive-compulsive disorder are realistic. The game does not give options to customize the avatar. The expressions of the non-player characters help to immerse the player in the story. |
| | AI & Adaptivity | 3 | The game does not adapt the difficulty to the player, but it does guide when new enemies or ways of exploration appear. Choosing different paths in the story changes the interactions with the characters. |
| | Interaction | 3 | Interactions are simple and easy to learn, even if there is no tutorial. These are not progressively complicated in the game nor is interaction with other people offered. |
| | Feedback & Debriefing | 1 | The only rewards in the game are images for progressing and overcoming levels. This experience is not intended to carry out an information session or have a support teacher. |
| OVERALL BALANCE | Learning & Fun Balance | 10 | The experience is stimulating and fun in all the interactions, as well as allowing the player to know the problems of a person with depression and obsessive-compulsive disorder. The educational content is well distributed throughout the time and the difficulty is progressive. |
| | Can Learn vs. Must Learn | 8 | The obligatory and complementary contents are equitable. This learning is introduced in the relevant actions of the game and also in the exploration options, giving the possibility of knowing everything in its three possible endings. |

Measuring the game with the proposed metrics results in an Overall Rating of 60/100, the highest mark in this case study as Table 3 shows. Regarding the Game Overview, it achieves a good 27 score due to the excellent Game Dynamics and Aesthetics. The visual art and the music and sound easily keep the players in a constant tension as is expected in the survival horror genre. In addition, the exploration possibilities, difficulty progression, needed tactics and blocked items engage to complete all the experience. Apart from a simple and nice interface, there is a lack of certain elements as missions, punctuations, skills or rewards. The Educational Overview gets a low 15/40 score. The main issue of Neverending Nightmares is that the acquired knowledge is never tested. Some positive educational approaches are the interesting and different endings and the representations

accuracy. Nevertheless, there is still a lack of customization and adaptivity for the player. For the last rating, Overall Balance, it scores high with 18 points. This result owes to the much enjoyable experience and the good distribution of the mandatory and complementary contents through the relevant actions and exploration.

The necessary changes for Neverending Nightmares to improve its learning goals are related to the Game and Educational Overviews. Starting with the addition of more mechanics like missions, rewards and skills which should be needed to complete the game. Therefore, the objective wouldn't be just surviving anymore, so it will engage better the player using this new long-term interface and progressive difficulty. Concerning Instructional Strategies, the educational contents should be tested with renewed dynamics that adapt to the game style. For example, interacting with the characters via dialogues which offer multi-choice responses. Among the possible selections there should be an adequate response to the main character emotions based on the knowledge of depressive and obsessive-compulsive disorders. Depending on these choices the game paths and NPCs reactions will change, providing the adaptivity that was missing.

Volunteer's review:

Neverending Nightmares gets a lower overall average than the expert's rating, 56.42 versus 60, but this is the only game that the surveys approve. 10 of the 12 users consider it an acceptable and fun educational experience. The Game Overview mean is quite similar to the author's total punctuation, especially in Aesthetics and Technology & UE features. However, the score is higher in Mechanics and lower in Dynamics. Various surveyed rate the levels in which the game is distributed, as well as the items and characters responses, as acceptable. On the contrary, there are users who have not perceived the gameplay so challenging or makes curious as to be excellent or good.

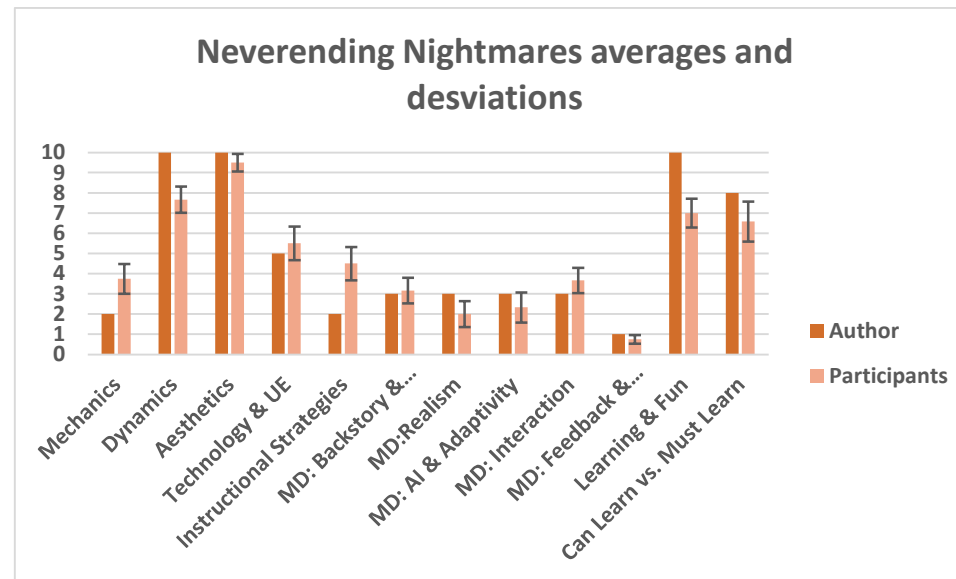


Figure S6. Neverending Nightmares' comparison of results between the author and the participants.

The Educational Content average is 16.42 versus the author's 15. The characteristic they rated the highest was Instructional Strategies. Users have valued more positively that the game is interesting, and fun, besides survival horror is not associated with learning at all. The lowest average compared to the expert rating corresponds to Overall Balance, 13.58 against 18. Learning & Fun scores better than Can Learn vs. Must Learn, but still these punctuations are smaller because players don't know the learning content as clearly as the expert who evaluates it. The standard deviation in the total scores for each section shows the lowest values of the 3 games. Therefore, it can be highlighted that players perceive the game as the most fun experience, with well-planned and balanced gameplay.