A Participatory Approach to Redesigning Games for Educational Purposes

Stamatia Savvani[1] and Antonios Liapis[2]

1: University of Essex, Essex, UK
2: University of Malta, Msida, Malta
s.tia.sava@gmail.com, antonios.liapis@um.edu.mt

Abstract. Even though games designed for educational purposes can be motivating, they usually shelter dated pedagogies, passive learning procedures, and often overlook learners' creativity. In an effort to reinforce the active participation of learners in games, this paper presents a participatory process in which students and teachers are involved in game design. The proposed process concerns redesigning existing commercial games into educational ones and includes establishing the learning goals, identifying appropriate commercial games, adapting the rules and context, crafting and playtesting the game. Using language learning as one application of this process, the paper presents how three well-known tabletop games were redesigned in a foreign language classroom with elementary and intermediate English language learners. The benefits that underlie the process concern students' active participation, boosting their problem-solving skills, and engaging them in creative learning.

Keywords: Game-Based Language Learning · Student-Centered Pedagogies · Participatory Design · Creativity in Education · Tabletop Games.

1 Introduction

Designing games for educational purposes can be a challenging venture as the golden ratio between fun, learning and pedagogy [2] is difficult to achieve. Focusing solely on game elements or complex rules may detach the game from its learning purpose. On the other hand, scattering game elements in an educational activity just for the sake of it may lead to an unsatisfying game experience.

Students today are digital natives and have been exposed to a plethora of digital games. They are immersed daily in unique digital environments, and have learned to adapt easily to demanding game mechanics. Therefore, educational gamified activities might grasp learners' attention in the beginning, but may prove insufficient in the long run [14]. Students are highly perceptive and recognize the struggle of those educators who try to turn a learning exercise into a game. Unless this is done elegantly, they may quickly lose interest in an educational game. Educational digital games often feel more like gamified quizzes [13] and fail to address higher order thinking skills of learners. Even major digital platforms for language learning such as Duolingo employ behaviorist teaching

practices, i.e. translation and repetition, mixing them with advanced gamified rewards [18]. A noteworthy exception is Tinycards by Duolingo, which allows the users to create their own flashcards for teaching or learning purposes, thus soliciting their creative skills [18].

This paper contends that merely *playing* games designed with closed-ended, behaviorist teaching practices does not evoke sufficient creative thinking skills by the students. Instead, *creating* game content that others can enjoy, e.g. in Tinycards, requires the utmost of high order thinking skills [8]. To facilitate creation in the classroom, we propose simple and inexpensive paper-based methods for the participatory design of tabletop games (card games, board games, or puzzles). While teachers take the initial decisions regarding the learning goals and constraints of such a game, learners can be involved throughout the process and especially when crafting the game. Games designed in class may be simple (and even behaviorist in their gameplay), but the act of creating the game engages and empowers students, turning them from *passive players* to *active designers*. The focus and examples in this paper are on game (re)design in a foreign language classroom, which matches the principles of Content and Language Integrated Learning [10]. However, the redesign process of popular tabletop games can be applied to any subject and learning goal.

2 Related Work

According to [6], participatory design (PD) refers to a democratic process of design "actively involving all stakeholders (e.g., employees, partners, customers, citizens, users) in the process to help ensure the result meets their needs and is usable." While PD has its roots in User Experience design, it has been applied to a plethora of settings, including education [15]. Participatory design is not always perfectly democratic as it can involve varying degrees of domain expert (end-user) and design expert participation [15]. For instance, informant PD limits the role of end-users, while facilitated PD gives end-users complete freedom and initiative, leaving a supervisory role to the design experts.

Participatory design is essential to new educational practices, as modern pedagogies and technology-enabled classrooms call for more student-centered approaches [5]. It is expected that the role of teachers will shift significantly as emerging pedagogies such as project-based learning, game-based learning or inquiry-based learning require students to be active participants and take responsibility and initiatives in their learning [1].

Active learning strategies [7] often subvert the traditional roles of teachers and learners. The teachers are not expected to be "sages-on-stage" but rather "guides-on-the-side" [11]. While the teacher embraces a supervisory role, this does not lessen teacher effort. On the contrary, the teacher must prepare well beforehand for active learning experiences to be successful [7]. Depending on the activity, the preparation of the teacher may entail deciding on the learning tasks, students' roles, materials provided, and time allocated. This is also true for the game redesign process described in this paper, especially Stages 1 and 2.

3 The Redesign Process

The redesign process follows a number of successive steps, outlined below. Many of the steps require the presence and active participation of both educators and learners (to different degrees). While the process focuses on use in the English language classroom, the steps are simple to follow and provide a practical guide for adapting games that would be suitable for enhancing the learning experience of different school subjects.

Stage 1: Set the learning goals: In this stage the teacher identifies the learning goals and focus of the game to be produced. As in lesson planning, it is of major importance to crystallize the game's objectives and have clear and straightforward outcomes expected by students. Establishing the subject-related content needs of the game is a starting point of the game design process [20]. Useful questions to ask are "What will I teach with this lesson-game?" and "What will my students achieve?" [3] to determine the goal of the game. For instance, if a language teacher decides to co-design with her students a game that would reinforce vocabulary connected to holidays, then that would be the learning goal. The second question should be answered with action verbs that demonstrate student outcome, e.g. spell words related to holiday correctly, identify meaning of words. Deciding on the game's learning outcome helps the teacher search for appropriate games in Stage 2.

Stage 2: Choose a commercial game: In this stage, the teacher chooses a popular game that could be adjusted to meet the specific learning goals set. The more experienced the teacher is with different kinds of games and their mechanics, the easier it may be to get inspiration. While there are many tabletop games and genres to choose from, not all are suitable for educational purposes: the four main criteria for choosing an appropriate game are *popularity*, *playtime*, *complexity*, and *theme*. It is advisable to ask students about games they enjoy or are most familiar with, as this would increase their engagement while reducing teacher effort to explain the game. Playtime is especially important, as the games will usually be played within a (small) portion of a teaching hour. Complexity should also be considered; the heavier the game is in terms of rules and/or components, the harder it would be to explain, adapt and redesign. Last, the theme of the game itself should be considered, maturity- and age-wise. The boardgamegeek[1] database can be a helpful source of inspiration during this stage as it offers crucial statistics about commercial games such as intended number and age of players, playing time, complexity (as "weight"), categories and mechanisms. If we look up the *Gaia project* (Feuerland Spiele, 2017) on boardgamegeek[2], for instance, we find that it is a poor choice for a language classroom given that its playtime can last up to 150 minutes and its weight scores 4.28 out of 5. Adapting the rules of such a game in Stage 3 would likely be more difficult than designing one from scratch.

[1] `https://boardgamegeek.com`
[2] `https://boardgamegeek.com/boardgame/220308/gaia-project`

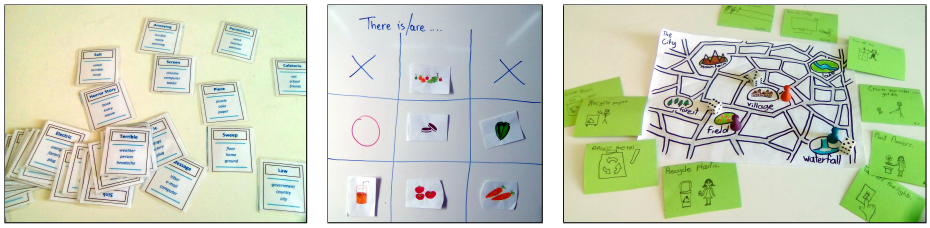
Stage 3: Adapt the rules: In this stage, rules are removed, added or changed to match the target audience, learning goals, and playtime. This stage can be the most laborious, requiring multiple playtests (Stage 6). This stage involves removing unnecessary subsystems of games, modifying winning conditions, simplifying reward mechanics, and introducing rules specific to the learning goals.

As an example, if the game to be redesigned is Monopoly, one may opt to keep the set collection mechanic but remove the Chance and Community Chest card components or the subsystem of building hotels and houses. Similarly, while in Monopoly the winner is the player who does not go bankrupt, this condition may be modified to shorten playtime and match more pedagogical sensibilities; instead, the game could end when one player occupies all properties of one color (set). Lastly, additions would be made to include learning content, e.g. substituting the sets of street names in Monopoly with verb sets, featuring the present, past and past participle of an English language verb. Similar to Monopoly, the player landing on an unoccupied property must use the verb of the property in a sentence correctly (new mechanic) in order to occupy it.

As with the learning goals, the game mechanics (what a player does in this game) should be defined clearly with action verbs, such as move, collect, describe [19]. As argued above, making a poor choice for a base game in Stage 2 may require more class effort to adapt and remove rules than on learning goals. The audience needs to engage more with the language and content of the lesson than the rules of gaming [9]. After students have designed a number of games with the teacher, they may have their own ideas of what could also work as a rule system. However, game (re)design can be an intensive, time consuming process. Therefore, it is best if the teacher initially preoccupies herself with this stage.

Stage 4: Adapt the content: In this stage, the class brainstorms the content that could fit into the game, drawing from the goals established in Stage 1. Modifications can be made to the theme of the base game, making it more age- and level-appropriate for learners. The vocabulary on the board and game cards can be adjusted to fit the learning purposes and learners' language level. Language may even be absent from the game components altogether, but it may be elicited during gameplay. The learning content to be included could be established during a pre-game design activity. For instance, the teacher may ask students "Which words from today's lesson did you find most difficult?". Students then share their feedback on the vocabulary taught and create a word list with the teacher, which would then be used as part of the game's word cards. It is important that such interactions take place, as they help learners reflect on their knowledge and address their metalignuistic awareness [12], while also engaging them in the design process.

Stage 5: Craft the game: Crafting the game is the implementation stage of the process, requiring the active engagement of both teacher and learners. First, the teacher should make the game rules clear so that learners can craft the game accordingly, and lead a short objective discussion of the game to finalize



(a) Taboo (b) Tic-Tac-Toe (c) Pandemic

Fig. 1: Tabletop games redesigned for the English language classroom.

the game goals and expectations. Crafting the game involves learners creating game components: writing words, drawing a board, cutting cards, and finding appropriate pawns. Having learners lead the crafting process, or even undertake it in full, can increase their personal investment in the game. For instance, being able to personalize their tokens to match their identity can have a strong impact on enjoyment and presence [22]. Ideally, the game parts should include language, topics and content taught previously. With more advanced learners, a manual with the adapted rules could also be crafted in the target language.

Stage 6: Playtest the game: In a successful game redesign, playing the game in the classroom may mark the end of the activity. Often, however, the first playtest will reveal flaws that require further adjustments. The teacher can discuss the results of the playtest with students. This not only solicits critical thinking about both the rules and the content, but can lead to new redesign iterations (often at Stage 3 or 4) and another playtest.

4 Cases of Redesign for the English Language Classroom

To further demonstrate how the process can be practically implemented in real-world settings, this section describes the redesign process of three commercial games: *Taboo*, Tic-Tac-Toe, and *Pandemic* (see the resulting games in Fig. 1). These games were redesigned during the school year 2018-2019 in a small private school for teaching English as a foreign language (EFL). Elementary and intermediate language learners participated in the design of these games; the students' age ranged from 10-13 years old. Classes consisted of 6 to 10 students, and students' native language was Greek. The first author was the EFL teacher, with four years of prior experience working in the same school. She supervised the redesign process at all times, and had spent adequate time preparing and searching for suitable games that could easily be redesigned within a teaching hour (approximately 45 minutes). The teacher was primarily responsible for Stages 1-3 while learners largely undertook Stages 5 and 6 under the teacher's supervision. The games listed below address mainly vocabulary and grammar skills of learners, but can be easily adjusted to suit learning objectives other

Table 1: Redesign of *Taboo*

Set the goals	Vocabulary consolidation
Choose a game	*Taboo* (Hasbro, 1989)
Adapt rules	Number of forbidden words is adjusted according to level
Adapt content	Words to be guessed and forbidden words based on vocabulary list
Craft the game	Teachers' role: evaluates and provides feedback on the cards
	Learners' role: create Taboo cards and add forbidden words

than consolidating linguistic content. Choices made in the first 5 stages are also summarized in tables, while results of the playtests are discussed in Section 5.

4.1 Taboo for Vocabulary Consolidation

Taboo (Hasbro, 1989) is a well-known party game in which players have to guess a hidden word. The player who knows the word can use any hints to describe the word apart from the forbidden words listed on the word card. *Taboo* can be used in the EFL classroom as a vernacular game [16]. Authentic materials can prepare students for real-life communication scenarios and provide meaningful context to language [21]. However, they are targeted to native speakers and frequently address cultural topics or colloquial language that might be unknown to EFL learners, while they are not carefully graded learning materials. Thus, vernacular games should be adjusted to the language context, e.g. the language level of students, their age, and other factors that may impact understanding [17].

In this case of redesign, students were asked to create "*Taboo*-style" cards for words that they have been taught and then play with them. In this case, the teacher adapted the number of forbidden words per card, reducing them to make the game easier (Stage 3). Students chose the words to be guessed and the forbidden word cards (Stage 4), wrote the first version of the cards on post-it notes (Stage 5) and tested it in class. The teacher evaluated whether their choice of forbidden words is successful and gave ideas on how to improve their word cards. After several playtests (Stage 6) where cards were adjusted and re-created as post-it notes, the teacher used a word processor to create stylized word cards (see Fig. 1a) based on students' post-it notes. The students helped in cutting and laminating the cards in a second iteration of Stage 5.

Redesigning *Taboo* cards provided a two-fold benefit. Students were exposed to the language (e.g. vocabulary lists) they had to learn and created a game that they can play with and understand. Given the popularity of *Taboo*, the teacher's effort in describing the game or assistance in redesigning rules and content was minimal. The teacher's role was important for assessing correct use of vocabulary or fair level of challenge between cards. This procedure can take place several times in a school year, e.g. before term exams to revise important vocabulary. By the end of the year, the students can combine all word cards made in different sessions and have a game with key vocabulary learned throughout the year.

Table 2: Redesign of Tic-Tac-Toe

Set the goals	Vocabulary and sentence structure practice
Choose a game	Tic-Tac-Toe
Adapt rules	Grid with images instead of blank grid. Use target language to claim and acquire an image on the grid
Include content	Images as prompts to evoke language
Craft the game	Teachers' role: provide ideas for images to be placed on the grid
	Learners' role: choose, draw and color images

4.2 Tic-Tac-Toe for Syntax Practice

Tic-Tac-Toe (or Noughts and Crosses) is a popular, simple pen-and-paper game in which a player claims a place on a three-by-three grid by drawing a circle or a cross; the winner must have three of these in a row. In a digital gamified version of Tic-Tac-Toe designed for EFL purposes by Burlington books, learners have to answer correctly a grammar or vocabulary question (in multiple-choice form) to claim a place on the grid. This behaviorist, filling-in-the-blanks practice does not solicit language productivity as it involves choice among a few options, and generally requires lower order thinking skills. Students are asked to recall their knowledge and identify the correct answers between two options, but they do not produce language. This game feels like a gamified closed-ended quiz [13].

Tic-Tac-Toe was redesigned during the teaching of quantifiers in English to describe food and object quantities. The key vocabulary of the specific class were the quantifiers, i.e. "(a) few", "(a) little", "a lot of", "lots of", "many", "much" and structures such as "There is(n't)/ There are(n't)". After learners were taught these structures, they brainstormed food items with the teacher (Stage 4) and were asked to create an image for each food item (one per student). This resulted in the production of 9 different drawings of food (Stage 5) which were placed on a classic blank Tic-Tac-Toe grid (see Fig. 1b). Students were then invited to play a Tic-Tac-Toe game, adapting the rules (Stage 3) so that students should use the target language to describe the image in order to claim that grid position.

Producing an entire sentence (e.g. "there are a few carrots") is an open-ended task and requires more creativity from the learners compared to the digital Tic-Tac-Toe gamified quiz. From a pedagogical viewpoint, it is more challenging to ask a student to produce a correct utterance by themselves than have them choose between options, as is the case with gamified grammar quizzes [13].

4.3 Pandemic for Content and Language Integrated Learning

Pandemic (Z-man games, 2008) is a cooperative board game with a fairly long playtime. The players' (common) objective is to use their characters' powers and special cards to cure diseases in different locations on the world map. Locations keep getting infected with disease cubes and the game is neither easily winnable nor simple to understand. Players have many possible actions to perform such as move, exchange cards, build structures, remove disease cubes etc.

Table 3: Redesign of *Pandemic*

Set the goals	Practice vocabulary relating to pollution and nature, raise awareness on environmental issues
Choose a game	*Pandemic* (Z-man games, 2008)
Adapt Rules	Reduce number of locations, remove infection cards, epidemics, disease cubes, simplify actions to two, new randomization and tracking of locations' threat, new winning condition, no losing condition.
Adapt content	Locations, types of pollution (air, water, earth), solution cards based on environmental policies
Craft the game	Teachers' role: elicit environmental solutions from learners, choose number & types of cards, inspect language used
	Learners' role: brainstorm environmental solutions, design the board, craft cards with text and images

The redesign of *Pandemic* was the most ambitious project, as both the rules and the theme were adapted extensively; it also shows the impact of choosing a more complex game in Stage 2 for redesign. The game was designed around Content and Language Integrated Learning [10] principles, which refers to the teaching of a subject through a foreign language. Thus, the learning goal (Stage 1) was two-fold: (a) expose learners to vocabulary related to nature and pollution, and (b) raise awareness on environmental issues. To shorten and simplify gameplay, the teacher undertook Stage 3 on her own and removed most subsystems of *Pandemic*. Players only take two actions in sequence: move to an adjacent location and use solution cards to alleviate the pollution from their location. Rather than using disease cubes as additional components, each location's pollution was recorded with a die (and initialized with a die roll). The board included rural and urban locations (see Fig. 1c). Students would collect and use solution cards to decrease and finally remove the pollution in each location. Solution cards are eco-friendly actions that learners could take in real life, such as "Pick up litter", "Use the bicycle more than the car", etc.

Students primarily participated in brainstorming locations and solution cards (Stage 4) and in crafting the game (Stage 5). Environment-friendly actions were elicited through discussion and prompts by the teacher, who also chose the theme of each card (e.g. water, air) which determines the location where it can be used (water solution cards can be used at the river and the lake). During this process, students had to discuss and reflect on social issues in the target language, increasing their interest as the actions affect their daily lives. During the crafting process, a student volunteered to draw the board at home while other learners created solution cards on post-it notes (see Fig. 1c). Due to the expansive changes to the base game, it is necessary to perform many playtests in the classroom or by the teacher alone, and the version of the game described can still be improved. In such expansive redesign attempts, the class can participate in multiple redesign iterations and platesting (re-running Stages 3 to 6) and teacher-led reflective discussion at regular intervals throughout the school year.

5 Conclusion

As illustrated by the use cases discussed above, the participatory design followed is friendly to amateurs in game design and even to students. Modifying an existing game is significantly easier than creating one from scratch.

Drawing from the experience of implementing the redesign process in the language classroom, the first author reports high level of engagement from students. While learners treat digital games designed for language learning as break time, they were actively involved during the redesign process of tabletop games. Adapting *Taboo* required effort from the teacher only in Stages 1 and 2; during Stages 4 and 5 the teacher embraced a supervisory role offering feedback on the cards created. While redesigning *Pandemic*, students offered many ideas in Stage 4 and overtook Stage 5 themselves, as they were happy to offer their artistic skills. Adapting Tic-Tac-Toe also required basic artistic input from students in Stages 4 and 5; while this game was by far the easiest to craft (each student created one card), students engaged in intense competition when playing it.

One may argue that some of the adapted games presented do not challenge students' higher order thinking skills, which was the main criticism for current language learning games. The main focus of the adapted *Taboo* and Tic-Tac-Toe is still vocabulary and grammar drilling, albeit with production of original language. However, higher order thinking skills of learners (such as creativity, evaluation, and cooperation) are addressed *during the design process*. Students are actively involved in the game design experience, which strongly resembles a lesson design experience. They are asked to reflect on knowledge they already know (Stage 4) and to assess their learning after playtesting (Stage 6).

The main limitation of this design approach is the amount of time and work invested in and out of class. On the other hand, the redesign process needs only to take place once; the games generated could be showcased to future classes, who could adapt the games already designed by their classmates (focusing on Stages 4 and 5). Another limitation is that the process has been tested in small language classrooms; the same process may be very demanding in larger classrooms (e.g. in a public school). This could be mitigated by breaking the class into groups that would create different variations of the same game. Lastly, a certain amount of game literacy is required from the teacher in order to make the procedures flow. This can be ameliorated by studying and playing commercial games available or by involving students earlier in the process (e.g. Stage 2).

While this paper focused on applying game redesign for EFL, the process can be used for any school subject. Content can be easily adapted, e.g. using learners' drawings of landmarks in a Geography-based Tic-Tac-Toe. Even rules can be adapted to suit the subject, e.g. to show attracting and repulsive forces as pawn movement rules in a Physics-based game redesign. Future work should evaluate the impact of the redesign process on users' engagement, learning effects, and personal impact such as increased environmental awareness [4]. The goal of this paper is not to assess the impact of the redesign process but rather to convince practitioners not to fear involving learners in challenging game design tasks.

References

1. Albion, P.: Project-, problem-, and inquiry-based learning. Teaching and Digital Technologies: Big Issues and Critical Questions (2015)
2. Carrión, M., Santórum, M., Pérez, M., Aguilar, J.: A participatory methodology for the design of serious games in the educational environment. In: Congreso Internacional de Innovacion y Tendencias en Ingenieria (2017)
3. Farrell, T.S.: Lesson planning. Methodology in language teaching: An anthology of current practice pp. 30–39 (2002)
4. Gualeni, S., Gomez Maureira, M.: Self-transformative effects of designing videogames and the challenge of capturing them quantitatively: a case study. In: Proceedings of the Foundation of Digital Games (2018)
5. Hannafin, M.J., Hannafin, K.M.: Cognition and student-centered, web-based learning: Issues and implications for research and theory. In: Learning and instruction in the digital age, pp. 11–23. Springer (2010)
6. Hartson, R., Pyla, P.: Chapter 11 - Background: Understand Needs. In: The UX Book (2nd edition). Morgan Kaufmann (2019)
7. Johnson, R.T., Johnson, D.W.: Active learning: Cooperation in the classroom. The annual report of educational psychology in Japan **47**, 29–30 (2008)
8. Krathwohl, D.R., Anderson, L.W.: A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. Longman (2009)
9. Kultima, A.: Casual game design values. In: Proceedings of the 13th international MindTrek conference: Everyday life in the ubiquitous era. pp. 58–65. ACM (2009)
10. Marsh, D.: CLIL/EMILE-The European dimension: Actions, trends and foresight potential. University of Jyväskylä (2002)
11. Morrison, C.D.: From sage on the stage to guide on the side: A good start. International Journal for the scholarship of teaching and learning **8**(1) (2014)
12. Nagy, W.: Metalinguistic awareness and the vocabulary-comprehension connection. Vocabulary acquisition: Implications for reading comprehension pp. 52–77 (2007)
13. Nicholson, S.: Making gameplay matter: Designing modern educational tabletop games. Knowledge Quest **40**(1) (2011)
14. Prensky, M.: Digital game-based learning. Computers in Entertainment **1**(1) (2003)
15. Read, J.C., Gregory, P., MacFarlane, S., McManus, B., Gray, P., Patel, R.: An investigation of participatory design with children-informant, balanced and facilitated design. In: Interaction design and Children. pp. 53–64. Eindhoven (2002)
16. Reinhardt, J.: Gameful Second and Foreign Language Teaching and Learning: Theory, Research, and Practice. Springer (2018)
17. Reinhardt, J.: Learnful L2 Gaming. In: Gameful Second and Foreign Language Teaching and Learning, pp. 19–43. Springer (2019)
18. Savvani, S.: State-of-the-Art Duolingo Features and Applications. In: International Conference on Interactive Collaborative Learning. pp. 139–148. Springer (2018)
19. Sicart, M.: Defining game mechanics. Game Studies **8**(2) (2008)
20. Sørensen, B.H.: Educational design for serious games. In: Serious Games in Education, pp. 101–122. Aarhus Universitetsforlag (2011)
21. Tomlinson, B.: Materials development. The encyclopedia of applied linguistics (2012)
22. Trepte, S., Reinecke, L.: Avatar creation and video game enjoyment: Effects of life-satisfaction, game competitiveness, and identification with the avatar. Journal of Media Psychology **22**, 171–184 (2010)