IPAcman – or how to gamify introductory phonetics and phonology education

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Abstract

The article introduces a new educational browser-based game named *IPAcman*. The game is a didactic tool which can be used in introductory courses on English phonetics and phonology and teaches the description of conservative RP phonemes with the proper linguistic terminology, pertaining to places of articulation, manners of articulation, and voicing (in consonants) or vowel height, backness and roundedness. A short survey performed on three groups of students who were taught with *IPAcman* reveals that the attitudes towards the use of computer games in university coursework are overwhelmingly positive and that learning through playing a computer game is judged to be both enjoyable and highly effective.

IPAcman **– czyli jak zgrywalizować**
wstępne kształcenie w zakresie fonetyki i fonologii

Abstrakt

Artykuł przedstawia nową edukacyjną grę przeglądarkową pt. *IPAc-man*. Gra ta jest narzędziem dydaktycznym przeznaczonym do użytku we wstępnych kursach angielskiej fonetyki i fonologii. Uczy ona podstawowego opisu fonemów konserwatywnej wymowy brytyjskiej RP za pomocą terminologii lingwistycznej odnoszącej się do miejsca artykulacji, sposobu, artykulacji, i dźwięczności (w wypadku spółgłosek) oraz pozycji języka i kształtu warg (w wypadku samogłosek). Krótka ankieta przeprowadzona w trzech grupach studentów wykorzystujących *IPAc-mana* podczas zajęć wykazała, że nastawienie studentów do wykorzystania gier komputerowych jako narzędzi dydaktycznych jest bardzo pozytywne, a nauka poprzez grę jest zarówno przyjemna jak i wysoce efektywna.

Słowa kluczowe

gamifikacja, fonetyka i fonologia, kształcenie akademickie

1. Introduction

In recent years, gamification has been becoming increasingly common in education, including higher education. However, a gamification approach in teaching linguistics appears not to be on record. The aim of this contribution is to attempt to fill this gap. *IPAcman* (2020) is an interactive game, which assists the teacher in conveying basic knowledge about conservative RP phonemes and is perfectly suitable for extensive use in introductory English phonetics and phonology courses taught in departments of English worldwide.

2. Gamification in higher education

According to Kapp (2012: 10), "[g]amification is using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning and solve problems". With these objectives in mind, a significant number of academic teachers have been employing games or game-based activities in their courses (Laskowski and Badurowicz 2014, Wiggins 2016, Varannai, Sasvari and Urbanovics 2017, Subhash and Cudney 2018). Since most of the currently enrolled university students are representatives of *Generation Z,* they were born into a world in which computers and technology are an inextricable part of life. It is customary for representatives of this age group to display interest in gaming and have much experience with diverse types of online and offline games. For students of this kind, the so-called "digital natives" (Prensky 2001), traditional teaching methods may be less effective, and introducing a gamified approach can be much more commensurate with the reality which current students are best familiar with.

3. *IPAcman* – game mechanics

IPAcman is a simple game, the objective of which is to direct the game character, Pacman, towards eating the phoneme which fits the description depicted in the box in the right-side panel.

Pacman moves on a two-dimensional board (20x30 units) with the help of arrow keys or, for more advanced users, with Vim keys (h, j, k, l). At each time, there are six randomly selected phonemes on the board, designated with either their IPA (default) or X-SAMPA symbols. Phonemes can either stand still or move at a slow, medium, or fast pace, depending on the settings selected by the user. Each player has three lives at the game outset. After a phoneme description is displayed in the right-side panel, the user is expected to bring Pacman to the matching element. If correct, the user's score is increased. Otherwise, they

lose one of their lives. At any point in the game, the user can display their mistakes and the correct answers.

Users can also create an account and log in with their custom data. As long as they are logged in, all attempts, results, and mistakes are sent to the database and they can be retrieved at each subsequent login. The best results are aggregated in a leaderboard, which makes it possible for students to compete against each other.

Figure 1 depicts the initial state of the game, in which the board is empty and the player selects the alphabet (IPA or X-SAMPA) and the pace of the phonemes.

Figure 2 shows the state of the game after several attempts. The board is filled with six randomly generated phonemes, and the box on the right-side panel specifies that Pacman should aim for *a voiceless obstruent*.

After a player makes a mistake and loses one of their lives, they may click *View your mistakes* in the bottom right corner of the screen. Figure 3 depicts the window which opens afterwards.
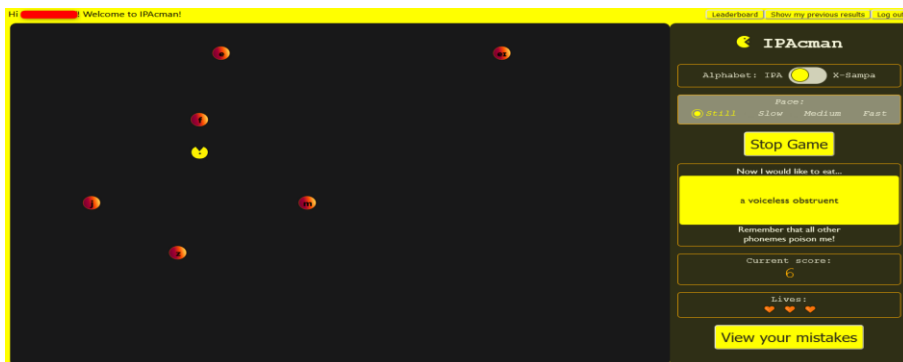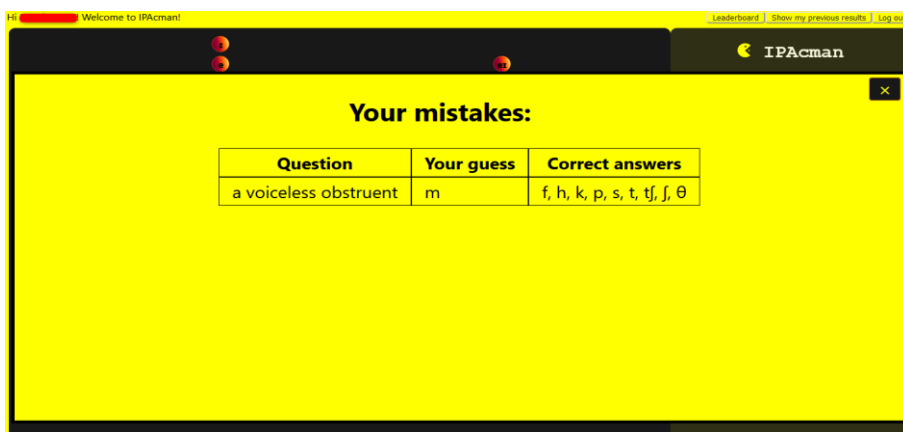

Figure 1

Figure 2

Figure 3

In this way, the game provides the student with a constant feedback loop – the correct answer can be checked immediately after a mistake. This makes the entire learning process very effective and interactive.

The question database of the game consists of 97 predefined questions, each of which can target one or several RP phonemes. Questions can be general ("an obstruent", "an approximant") or very precise ("a voiceless bilabial plosive").

The inventory of phonemes adopted in the game is that of conservative RP as typically taught in introductory courses on phonetics and phonology intended for non-native speakers of English. Symbols in Table 1, adopted from a classic textbook by Roach (2009: x), correspond to the inventory used in *IPAcman.*

Future updates to IPAcman may supplement the above inventory with those of other, more modern approaches to British English phonology, as well as with inventories of other varieties of English.

Table 1

The phonemic inventory used in IPAcman

Consonants	p, b, θ, ð, t, d, s, z, ʃ, ʒ, tʃ, dʒ, h, m, n, ŋ, l, r, j, w
Monophthongs	iː, uː, ɑː, ɔː, ɜː, ʊ, ʌ, æ, ə, ɪ, ɒ, e
Diphthongs	eɪ, aɪ, ɔɪ, əʊ, aʊ, eə, ʊə, ɪə

4.   *IPAcman* – technical characteristics

IPAcman is a web-based application, available through a web browser. It was coded with ReactJS on the front-end and connected to Google Firebase as a simple database solution. The database stores user login data and details on player attempts.

5.   Survey

In December 2020 and January 2021, a simple survey was conducted in order to determine the attitude of university students towards IPAcman as a didactic tool. The survey was directed at three groups of students (two BA-level groups and one MA-level group) of the Department of English at the University of Gdańsk (Poland). It consisted of eight compulsory closed questions and three optional open questions. Altogether, 41 responses have been gathered.

The first question was demographic and its aim was to specify the ratio of BA and MA students:
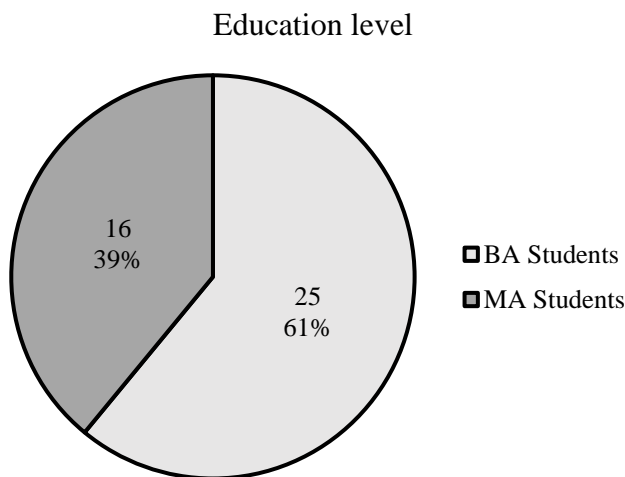
Education level

Figure 1
Education level of IPAcman players

According to the survey, 25 students (61 %) were enrolled in a BA programme in English studies (teaching specialization), and the remaining 16 students were MA English studies students (Natural Language Processing specialization).

The next question was about the amount of time spent by the students on playing *IPAcman*.

The majority of students (59 %) spent between one and two hours on *IPAcman*, and 32 % spent between three and five hours. There were also few participants who spent less or more time on the game.

One or two hours may seem to be a short exposure, but in fact, playing for an hour is enough to entail thorough revision of a significant number of examples. By spending more than three hours, a student can make sure that they go through virtually all available questions and possess the skill of describing RP phonemes at a satisfactory level.

In question three, an attempt was made to verify if playing *IPAcman* was considered enjoyable by any students.
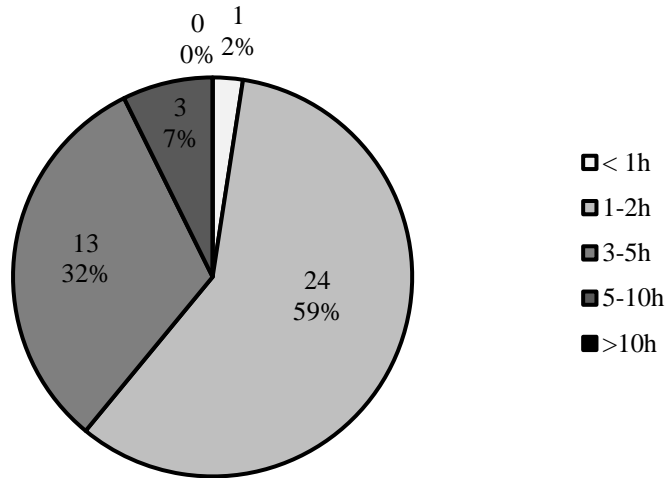
How many hours did you spend playing IPAcman?

Figure 2
Time spent on playing IPAcman

Next, students were asked to subjectively evaluate the educational value which IPAcman brought to them.

Once again, the results were surprisingly positive and encouraging. Most students (59 %) unambiguously confirmed that *IPAcman* helped them to learn the required material and pass the test. They were followed by a group of 16 students who expressed their approval in a more reserved way ('probably yes'). Again, no single participant directly stated that *IPAcman* was not helpful.

In question five, the issue of competition was addressed. According to many researchers, competition can have a positive impact on the motivation and performance of students (Zimmerman 1989, Burguillo 2010). *IPAcman* implements com-petition-based learning by providing a leaderboard with the ten best results, and to some students, it has become important to secure their place on the board.
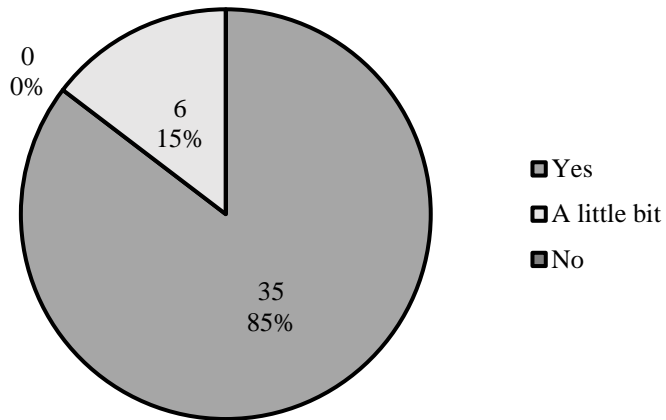
Did you enjoy playing IPAcman?

0
0%

6
15%

☐ Yes
☐ A little bit
☐ No

35
85%

Figure 3
Enjoyment associated with playing IPAcman

Do you think that IPAcman helped you
master the material and pass the test?

1
2%

0
0%

16
39%

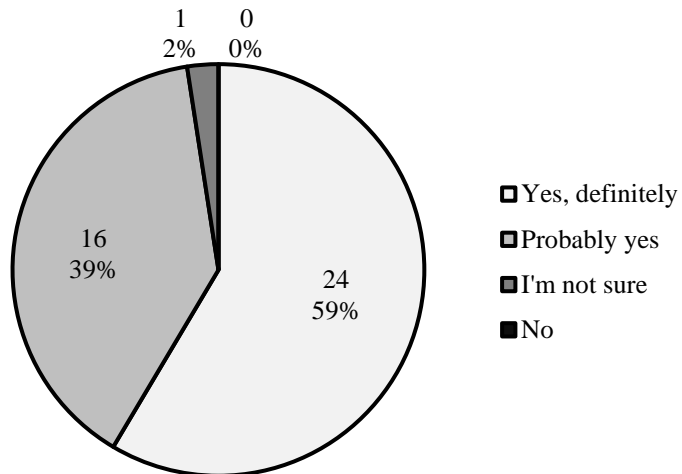24
59%

☐ Yes, definitely
☐ Probably yes
☐ I'm not sure
■ No

Figure 4
Effectiveness of IPAcman

Did you find it motivating that you were
competing with your groupmates?

0
0%

6
15%

20
49%

15
36%

□ Yes, very much so

□ Yes, to some extent

◨ I don't think so, it's
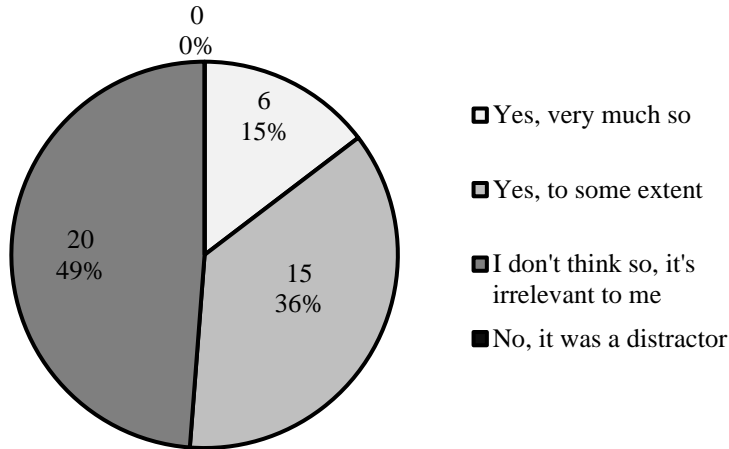   irrelevant to me

■ No, it was a distractor

Figure 5
Motivational aspect of competition

Slightly more than half of the participants (51%) admitted that competing against their groupmates did make a difference. The remaining half stated that they were indifferent to this fact. Importantly, no participant believed that competition distracted them from actual learning.

The remaining three closed questions focused on gamification in education in a general sense, rather than on *IPAcman*.

Question six aimed at discovering the extent to which gamification (in the digital form) has been used in the students' past education and contributed to their experience:

The results were disappointing, with 40 students (90 %) claiming that *IPAcman* was the first time they had ever played a computer game in class. It appears that, at least in the Polish context, computer games are never used in university-level education (although it does not follow those other forms of gamifications are not being employed).

Have any other university teachers used computer games
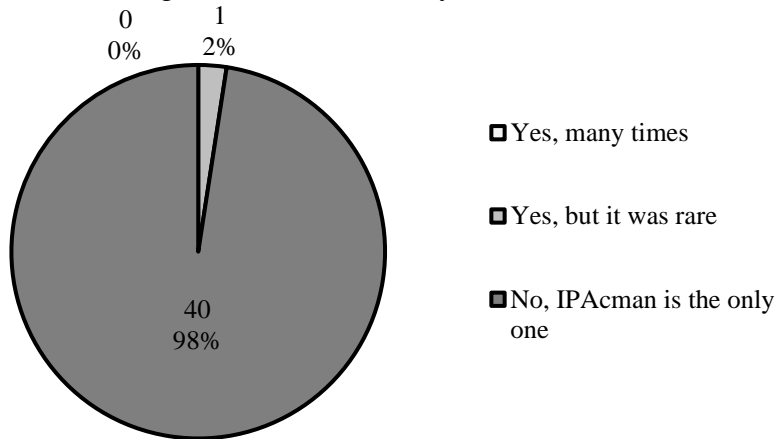as teaching tools in the courses you have attended?

0
0%

1
2%

Yes, many times

Yes, but it was rare

No, IPAcman is the only
one

40
98%

Figure 6
Experience with digital gamification in university education

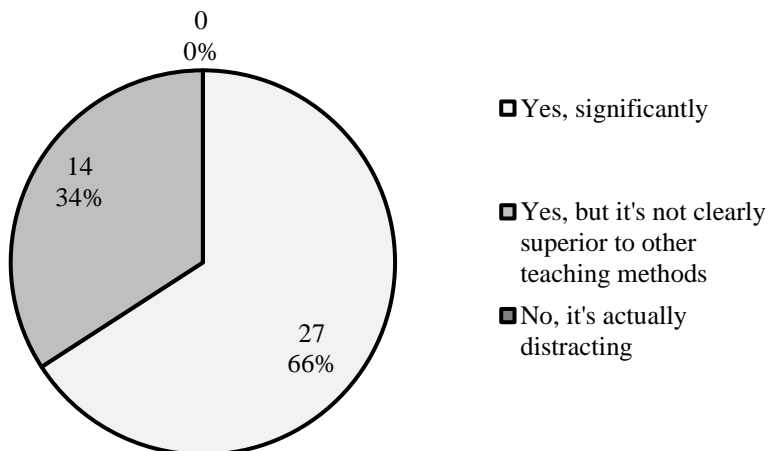Do you think that gamification makes it
easier to master the course material?

0
0%

Yes, significantly

Yes, but it's not clearly
superior to other
teaching methods

No, it's actually
distracting

14
34%

27
66%

Figure 7
Gamification as a facilitating factor

Question seven investigated the attitude of students to-wards gamification from the perspective of easing the difficulty of mastering the required course material.

All of the students unanimously agreed that gamification is a great facilitator, although 34 % did not recognize its superior-ity to more conventional teaching methods.

In the last closed-ended question, the students' opinion was solicited on the potential usage of computer games in university courses.

As many as 98 % of the students indicated that computer games deserve a place in university curricula as fully valid teaching materials. Nonetheless, only 22 % of the survey par-ticipants wanted to integrate computer games into each individ-ual course, while the others adopted a more restrained ap-proach and were willing to limit the use of computer games to selected relevant contexts.

Do you think that computer games should be
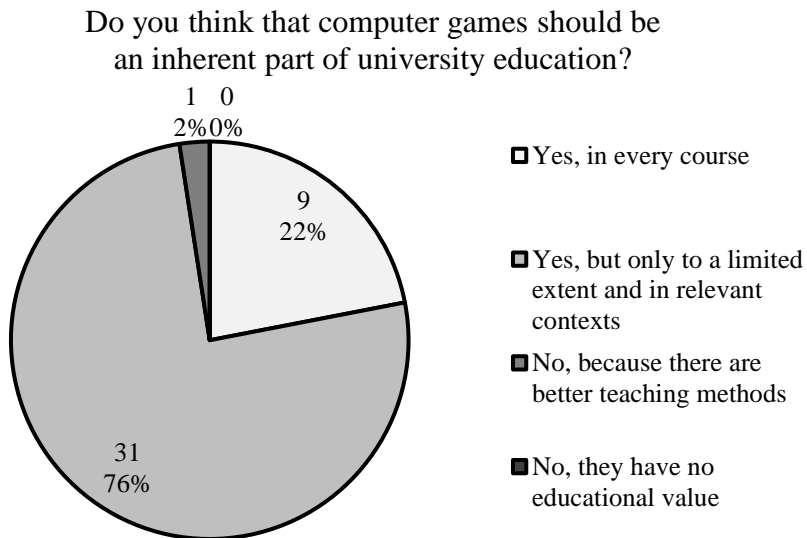an inherent part of university education?

Figure 8
Computer games as part of university education

The remaining three questions were open and optional. As a result, not all participants gave an answer, and some of the answers were very general and superficial. Only a selection of representative answers will be quoted below.

Question nine was 'What did you like best about *IPAcman*?'. Students' answers mostly focused on one of the following features:

- fun combined with educational value,
- clear and simple interface,
- possibility of viewing one's previous mistakes and learn from them.

Other answers included nostalgic associations with the traditional Pacman and competitiveness. The most noteworthy comment is the following example, in which the didactic superiority of *IPAcman* over traditional teaching methods is emphasised:

> *It was fun to play and at the same time repeat* [revise] *the material from the classes, I had hardly learn* [sic] *from the paper sheet - all I know about phonemes is thanks to IPAcman*

In question ten, students were asked about the potential changes which they would introduce to *IPAcman*. The most common answer was 'nothing', but there were a number of issues identified by some participants:

- the colour scheme (especially the saturation of yellow),
- the lack of sound,
- the number of available lives should be modifiable.

Other, more creative, proposals included switching the game to the snake engine, so that all of the eaten phonemes would become part of the character's tail.

The last question of the survey was about the students' potential ideas for other educational linguistic games. This was also the least popular question, with only a few answers. Two ideas are noteworthy:

- a *Tetris* clone which would involve building transcribed words out of blocks of IPA symbols,
- an application displaying mouth animations to aid learning proper pronunciation (potentially with game elements).

To sum up, the results of the preliminary survey are very promising and show how deeply positive the students' attitudes are towards the gamification of university education.

6. Conclusion and future perspectives

The creation of *IPAcman* and gamifying introductory phonetics and phonology courses is an audacious enterprise, especially due to the apparent scarcity of games suitable for teaching linguistics. Nevertheless, the preliminary investigations appear to yield optimistic results, with the students both acquiring the required course material faster and explicitly declaring their full approval for the gamified approach.

Obviously, it must be stated that not all teaching can be relegated to a computer game. One of the lurking disadvantages of this approach is that it may contribute to a dehumanization of education. Even though students quickly learn to select correct answers within the game, they may be less aware that the practised terminology still refers to the *human* vocal ap-paratus and *human* articulation. To emphasise this aspect, there is still a need for a human teacher, who will use the game as only one of the tools in their toolbox of teaching materials.

To sum up, *IPAcman* constitutes a brand new teaching aid which offers unprecedented advantages. It is to be hoped that *IPAcman* is not the last specimen of its kind and that other games facilitating teaching linguistics will follow.

References

Burguillo, Juan C. (2010). "Using game theory and Competition-based Learning to stimulate student motivation and performance". *Computers & Education* 55/2: 566–575.

Fortuna, Marcin (2020). *IPAcman*. Available at <https://ipacman.surge.sh>. Accessed 1.02.2021.

Kapp, Karl (2012). *The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education.* San Francisco: Pfeiffer.

Laskowski, Maciej, Marcin Badurowicz (2014). "Gamification in higher education: A case study". In: *Human Capital without Borders: Knowledge and Learning for Quality of Life*. Portorož: ToKnow-Press.

Prensky, Marc (2001). "Digital natives, digital immigrants". *On the Horizon* 6/5: 1–6.

Roach, Peter (2009). *English Phonetics and Phonology: A Practical Course*. Cambridge: University Press.

Subhash, Sujit, Elizabeth A. Cudney (2018). "Gamified learning in higher education: A systematic review of the literature". *Computers in Human Behavior* 87: 192–206.

Varannai, Istvan, Peter Sasvari, Anna Urbanovics (2017). "The Use of Gamification in Higher Education: An Empirical Study". *International Journal of Advanced Computer Science and Applications* 8/10: 1–6.

Wiggins, Bradley E. (2016). "An overview and study on the use of games, simulations, and gamification in higher education". *International Journal Game-Based Learning* 6/1: 18–29.

Zimmerman, Barry J. (1989). "A social cognitive view of self-regulated academic learning". *Journal of Educational Psychology* 81/3: 329–339.

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