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# Microbes Against Humanity, a workshop game for horrible students: using a creative card game in higher education microbiology teaching

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**Abstract**

Introducing creative workshops in higher education curricula, in addition to formal lectures, is an excellent way of reinforcing knowledge and encouraging creative thinking. In particular, the use of card games as a tool for inducing student engagement and enthusiasm has been reported to be a very effective approach. Here, we report an innovative card game-based workshop for use at the intermediate undergraduate level. The name of the game is Microbes Against Humanity and has been adapted from the widely known party game *Cards Against Humanity,* which is freely available under a creative commons licence. Overall, 64 students and two academics participated in this 2 h workshop. Our students found the workshop to be very enjoyable, considered it to be helpful for their learning and suggested interesting ideas for further improvement. In conclusion, it was shown that such exciting workshops can trigger students' enthusiasm for microbiology and enhance their learning potential.

## INTRODUCTION

It has been long understood that the teacher-centred type of teaching in higher education is no longer the best model. In an attempt to improve this, many universities use group work tutorials or workshops, in parallel with classic lectures. These workshops motivate the students to sharpen their teamwork, communicate effectively, think critically and develop their problem-solving skills by focusing on real-life scenarios.

The use of games in higher education is often termed gamification and aims to make learning more appealing [1, 2]. Gamification has become of great importance, especially after the recent launch of the Teaching Excellence Framework (TEF) in the UK, after which many of the traditional teaching approaches were scrutinized. Game-based methods were applied to a variety of different disciplines, ranging from accounting to microbiology [2, 3].

There are several recent examples of card game-based activities in higher education, in areas such as anatomy, evolution, immunology and DNA replication [4–9].

The aim of Microbes Against Humanity is to trigger students' enthusiasm for microbiology-related topics, encourage them to speak the names of microorganisms, associate particular organisms with specific diseases and consider individual scenarios. The game has the added advantage of breaking down barriers between the academic and the class owing to the often mature nature of the scenarios presented by using *Cards Against Humanity*.

## THE GAME

This game was introduced at The University of Strathclyde into our Biomedical Sciences curriculum for a biomedical microbiology class, which aims to highlight key bacterial, fungal, viral and parasitic pathogens, their pathogenicity mechanisms, and the diseases that they cause.

The materials of the game were adapted from the game *Cards Against Humanity*, which can be downloaded free of charge under a creative commons licence (https://cardsagainsthumanity.com/) and *Bacteria and Virus Trumps*, which are available from the Centre For The Cell (London, UK) (https://www.centreofthecell.org/) [10]. An overview of the card types and the game phases is shown in Fig. 1.

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**Keywords:** card game; Microbes Against Humanity; microbiology; higher education; gamification; creative teaching.

**Abbreviation:** TEF, Teaching Excellence Framework.

Supplementary material is available with the online version of this article.

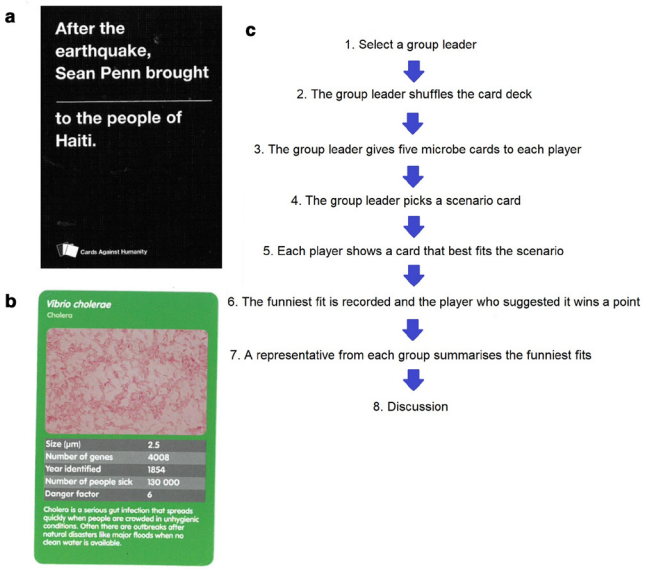


**Fig. 1.** Examples of a scenario card (a) and a microbe trump card (b). (c) A flow chart of the game's main steps.

This was a 2 h interactive workshop, which was not assessed. In total, 64 students attended the class and were divided into eight groups of eight. All students were asked for feedback and 14 students answered our questionnaire. The questionnaire contained four questions and the student feedback can be viewed in Fig. 2.

Each group of students is supplied with a full set of trump and scenario cards and a handout detailing the instructions of the game and a form to record their winning combinations (Supplementary files, available in the online version of this article). The handout also contains a disclaimer explaining that no offence is intended by the game and that students can play microbe trumps instead if they wish (to date, nobody has elected to do this). First, each group selects a leader. The group leader shuffles the deck of cards and gives five microbe cards to each player. By reading each microbe trump card in their hands, the students can learn about each pathogen's morphology, size, pathogenicity and virulence factors (Fig. 1). Then, the leader picks a scenario card and reads it out loud. Each player then plays one of their microbe cards face down that fits the scenario. For example, if the scenario card says: 'My dad brought it back from Africa', a player can suggest the malaria parasite card. The funniest fit is recorded on one of the provided forms and the player who suggested it wins a point. The player with the most points wins the game (Table 1). Finally, at the end of the game, there can be a class discussion, led by the instructor in which each group takes it in turn to give some of their best combinations and explain whether the scenario is scientifically likely or not. The scenario in Fig. 1 is one of many examples that have an element of truth in the literature, although nobody is suggesting that it was Sean Penn's fault [11]

The different groups can compare their funniest findings. The instructor can link their answers with the learning outcomes of the microbiology class, the lecture material or perhaps recent news about microbiology, such as disease outbreaks or

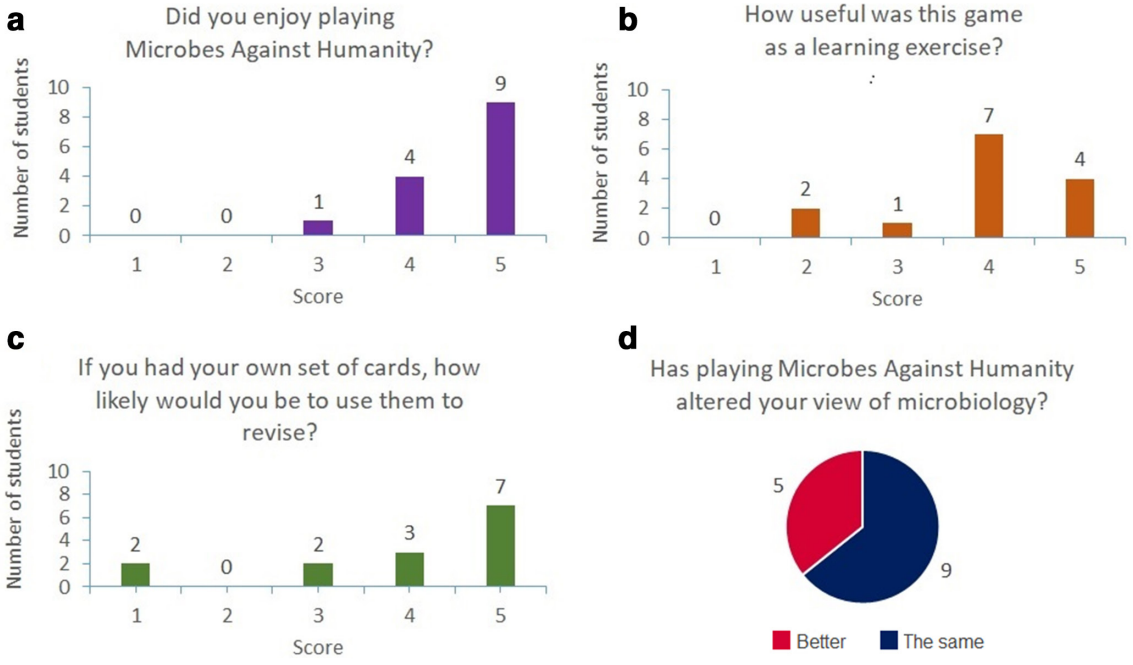


**Fig. 2.** The answers of the students when asked if they found the card game enjoyable (a), useful (b), motivating for revision (c) or view-changing regarding the field of microbiology (d). Here, 1: very unlikely; 5: very likely.

**Table 1.** An example of the game's answer sheet

| Scenario (black card) | Micro Card / s | Is it realistic or not and why? |
|---|---|---|
| "Maybe she's born with it, maybe it's_____" | *Chlamydia trachomatis* | Concept: vertical transmission of a pathogen from mother to child. Not impossible, but rarer than expected (Honkila et al., 2017) |
| "After the earthquake, Sean Penn brought _____ to the people of Haiti" | *Vibrio cholerae* | Concept: Natural disasters aid the spread of disease. It wasn't Sean Penn, but cholera outbreaks do occur after natural disasters. Haiti example predates the impact of Hurricane Sandy and was probably not due to the earthquake, but the strain was introduced from Nepal (Frerichs et al., 2012). |
| "Instead of coal, Father Christmas now gives the bad children _____" | Respiratory Syncytial Virus | Concept: diseases of childhood. There is no evidence that Father Christmas exists, but RSV does infect young children. |
| "Next from J. K. Rowling: Harry Potter and the Chamber of _____." | *Escherichia coli* O157 | Concept: Foodborne disease.<br><br>Judging by *Maggoty Haggis At Nearly Headless Nick's Deathday Party*, it is entirely possible. |
| "Airport security guidelines now prohibit _____ on airplanes" | SARS Coronavirus | Concept: Travel associated infection control.<br><br>Reality: SARS control measures were introduced at airports worldwide but it is very difficult to prevent due to asymptomatic carriers (Wilder-Smith, 2006). |

epidemics. In this way, the students translate a funny educative experience into learning motivation.

## OUTCOME AND FUTURE SUGGESTIONS

After the workshop, the students were asked to complete an online questionnaire to investigate if they found it useful and if they have any suggestions or ideas for further improvements. The results are shown in Fig. 2.

When asked if they enjoyed the game, 13 out of 14 students gave a score of 4 or 5. Most found it useful as well, with 11 giving a score of 4 or 5. Ten students replied that they would be inclined to use a microbe card deck for their revision, if they owned one. Finally, five out of 14 students mentioned that this game improved their view of microbiology, indicating that their enthusiasm for this area was probably boosted as well. This could positively affect their performance, as the creative nature of this game could spark fresh interest for further in-depth study on these microbial pathogens and their characteristics by exploration of textbooks and scientific papers

These results agree with the student feedback described in other similar gamificational interventions [4, 8]. It should be noted that the vast majority of the studies mentioned above, as well as in the Introduction, are very recent, confirming that introducing and disseminating such approaches is a new trend in the educational literature.

The proportion of the students who answered the feedback questionnaire was small (22%) and this probably mostly included the more motivated students. However, a few of the answers shown in Fig. 2 were not positive, so it appears that the less motivated students were also represented. In

addition, this small-scale study was carried out only in one higher education institution, so it is likely that wider data variation might be observed in larger studies covering more institutions. More in-depth feedback surveys could include questions about how this game affected the self-confidence, teamwork skills, creativity and inquisitiveness of the participants, as well as asking for follow-up feedback after the students have received their marks and reflected upon their annual performance.

The students also made several suggestions and comments about this game-based workshop. They asked for more microorganisms per deck, representation of beneficial microorganisms and viruses, better card shuffling, and longer and deeper discussions at the end of the game. There were also many positive comments about how innovative and helpful this workshop was, given by eight students. Although this was a workshop in a biomedical microbiology class, a similar card game with beneficial microorganisms, such as probiotics or drug-producing fungi and bacteria, could be used in applied microbiology classes for example. Viruses and bacteria were well represented in our decks, but pathogenic fungi and parasites are currently under-represented.

Other improvements could include asking the students to make their own cards by using information from reliable internet sources, linking the bacteria in the cards with the lecture material and the case study assignment, and designing an electronic version of this game, as students would be more motivated to play the game, given their proficiency with smartphones. In addition, an opt-in/opt-out option can be given to the students after a short game briefing several days before the workshop in case any of them do not feel comfortable with participating in the game. This would prevent awkwardness in the classroom.

In summary, the overall opinion of the students about this game was very positive, encouraging us to repeat it annually and consider introducing more games into our curriculum. Similar cards games can be applied to other disciplines (medicine, nursing, biology, biotechnology, etc.) and academic institutions. We hope that such creative approaches will significantly improve student performance and satisfaction in the years to come.

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Conflicts of interest
The authors declare that there are no conflicts of interest.

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