

# Feasibility, acceptability and educational signal of a congress-based gamified challenge in Clinical Microbiology and Infectious Diseases: a cross-sectional telemetry and survey study

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## Research Article

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**Additional Declarations:** No competing interests reported.

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# Abstract

## Background

Gamification is increasingly used in health professions education, but evidence regarding its implementation in real-world conference settings remains limited. ToREIMC is a mobile gamified learning platform based on clinical cases in Clinical Microbiology and Infectious Diseases. We evaluated the feasibility, engagement, educational signal and user perceptions of a brief ToREIMC-based competitive challenge conducted during a medical congress.

## Methods

We conducted a cross-sectional study using app telemetry and survey data collected during a congress-based gamified activity. Participants completed a 10-question clinical challenge through a time-weighted scoring system in which higher scores reflected both correct and faster responses. Registration data, previous exposure to gamified tools, prior use of ToREIMC, number of correct

answers, response time, final score and post-activity survey responses were analyzed. Survey items used a 5-point Likert scale. Descriptive analyses, Spearman correlations and internal consistency estimates were performed.

## Results

144 participations from 136 unique users were analyzed. The highest participation window was 13:00–14:00 h, accounting for 54/144 participations, 37.5%. More than half of unique users, 76/136, 55.9%, were potential new ToREIMC users because they either did not know the platform or had never used it. Mean accuracy was 5.95/10 correct answers; median accuracy was 6/10. Only 8/144 participants, 5.6%, achieved a perfect score. Median total response time was 132 seconds. Final score correlated strongly with correct answers and inversely with response time. Habitual ToREIMC users showed higher mean accuracy than participants unfamiliar with the platform. Survey responses showed high perceived educational value: 80.6% agreed that gamification can improve learning, 86.1% that trivia-based questions help identify knowledge gaps and 81.3% that competition increases motivation. However, 71.5% also agreed that gamification may trivialize complex clinical content.

## Conclusions

A brief congress-based gamified challenge in Clinical Microbiology and Infectious Diseases was feasible, highly accepted and capable of attracting new users while generating objective performance metrics. The intervention showed an educational signal by combining applied knowledge assessment, rapid clinical reasoning and self-perceived identification of knowledge gaps. Future studies should incorporate pre-post knowledge testing, longitudinal follow-up and comparator groups to determine whether this model translates into sustained learning gains.

## Trial registration

Not applicable.

## Background

Gamification, commonly defined as the use of game-design elements in non-game contexts, has become an increasingly visible strategy in health professions education. Its educational appeal derives from the possibility of transforming learning activities into interactive, goal-oriented experiences that incorporate feedback, progression, competition, points, rankings or challenges [1]. In medical education, these mechanisms may be particularly useful when the intended learning outcomes include repeated exposure to clinical reasoning, decision-making under uncertainty and recognition of knowledge gaps.

Clinical Microbiology and Infectious Diseases are especially suitable fields for case-based gamified learning. They require integration of microbiological data, antimicrobial pharmacology, epidemiology, host factors, diagnostic reasoning and therapeutic decision-making. However, the same complexity may also create tension: while short-form gamified questions can promote engagement and recall, they may oversimplify nuanced clinical decisions if they are not embedded in rigorous case design and explanatory feedback.

The broader literature on serious games and gamification in health professions education suggests potential benefits for knowledge, skills, motivation and satisfaction, although the certainty of evidence remains limited by heterogeneity, small samples, lack of comparators and limited assessment of long-term outcomes [2, 4]. Therefore, beyond controlled classroom settings, there is a need to evaluate how gamified educational tools perform in real-world professional environments, including medical conferences. Conferences are high-density educational spaces, but many activities remain passive and are rarely evaluated using objective telemetry [3].

ToREIMC is a mobile gamified learning platform, developed by CoREIMC, the Study Group for Residents and Young Specialists of the Spanish Society of Infectious Diseases and Clinical Microbiology (SEIMC). It is designed for physicians and microbiologists interested in Clinical Microbiology and Infectious Diseases. It is based on periodic clinical cases with four answer options, one correct answer and immediate explanatory feedback. The platform also incorporates rankings, achievements and team-based competition. During a medical congress, a short competitive challenge using ToREIMC was implemented as a stand-based activity.

In the context of cross-sectional medical education research, we define an educational signal as preliminary evidence that an intervention is associated with measurable learning-related processes, such as knowledge retrieval, performance differentiation, identification of knowledge gaps, or learner engagement. The term does not imply the demonstration of sustained knowledge acquisition, long-term retention, behavioral change, or patient-level outcomes. Specifically, we analyzed participant

characteristics, time windows of maximum activity, previous exposure to gamified learning and ToREIMC, objective performance metrics, response speed and post-activity perceptions.

## Methods

### Study design and setting

We conducted a cross-sectional telemetry and survey study during a congress-based educational activity using the ToREIMC mobile platform. The activity was conducted during the National Congress of the Spanish Society of Infectious Diseases and Clinical Microbiology, held from 27 to 29 May 2026. The challenge was open to congress attendees who voluntarily approached the activity area and completed the registration and questionnaire process.

The study was designed as a real-world feasibility and acceptability assessment of a brief gamified educational intervention. No formal sample size calculation was performed because the sample corresponded to a convenience sample of voluntary participants during the congress.

### Educational intervention

The intervention consisted of a short gamified challenge on Clinical Microbiology and Infectious Diseases. Participants answered 10 clinical or microbiological questions through the ToREIMC platform. Each item had four response options and a single correct answer. Questions were randomly selected for each attempt from a pool of 30 items, comprising by difficult in 4 easy, 3 moderate and 3 hard questions.

The maximum possible number of correct answers was 10.

The platform assigned a final score based on the number of correct answers and response speed. Therefore, higher scores reflected both greater accuracy and faster completion. This scoring system was intended to support competitive ranking, reduce ties and encourage rapid clinical reasoning.

### Participants

Eligible participants were congress attendees who completed the activity during the predefined congress period. For the main analysis, we included records from 28th and 29th May 2026 with a possible score range of 0 to 10 correct answers.

Unique users were identified using normalized email addresses. Because some participants completed the activity more than once, performance analyses were conducted at the participation level, whereas baseline characteristics related to prior experience were preferably described at the unique-user level.

### Variables and data sources

Telemetry data extracted from the platform included: participant nickname, email address, number of correct answers, final score, total response time, date and time of participation, and activity mode.

Survey data included two baseline items and six Likert-scale perception items (see supplementary Table 1). Baseline items assessed: previous use of gamified learning tools and previous knowledge or use of ToREIMC. The six Likert-scale items were scored from 1 to 5, where 1 represented total disagreement and 5 represented total agreement. They assessed the following domains:

1. Perceived ability of gamification to improve learning.
2. Usefulness of trivia-type questions to identify knowledge gaps.
3. Motivational effect of competition.
4. Risk that gamification may trivialize complex clinical content.
5. Comfort when solving clinical questions in Clinical Microbiology and Infectious Diseases.
6. Self-perceived ability to apply microbiological concepts to clinical or therapeutic decisions.

The educational signal was operationalized using three complementary indicators: (1) objective performance, assessed through accuracy scores; (2) response efficiency, assessed through task completion time; and (3) perceived educational value, assessed through self-reported identification of knowledge gaps and perceived learning improvement.

The questionnaire was developed specifically for this study and had not been previously published. Prior to data collection, items were grouped into conceptually related domains by consensus among the authors based on face validity and intended educational constructs. These groupings were considered exploratory and were used solely to estimate internal consistency rather than to validate a formal psychometric scale.

### **Data cleaning**

The analytic dataset included 144 participations from 136 unique users. There were no missing survey responses in the final dataset.

Date and time values were converted from Coordinated Universal Time to Europe/Madrid local time. Response time was converted into seconds. Likert-scale items were converted into numeric variables from 1 to 5.

### **Statistical analysis**

Categorical variables were summarized as counts and percentages. Continuous variables were summarized as means and standard deviations or medians and interquartile ranges, depending on distribution and interpretability. Accuracy was reported as number of correct answers out of 10. Response speed was reported as total seconds and seconds per question.

The association between final score, number of correct answers and response time was assessed using Spearman correlation coefficients. Prior ToREIMC use was analyzed as an ordinal variable and correlated with number of correct answers. Internal consistency was estimated using Cronbach's alpha for

conceptually related survey domains: educational acceptance, including perceived learning improvement, identification of knowledge gaps and motivation; and clinical self-efficacy, including comfort with clinical questions and ability to apply microbiological concepts. The item on trivialization was analyzed separately because it was considered a distinct construct rather than a simple reverse indicator of acceptance. All analyses were exploratory and performed using IBM SPSS Statistics, version 31.0 (IBM Corp., Armonk, NY, USA). No imputation was performed.

**Use of artificial intelligence-assisted writing tools**

A large language model, ChatGPT (GPT-5.5 Thinking), was used exclusively for proofreading the final manuscript draft, including grammar, spelling, clarity and language refinement. The tool was not used for study design, data analysis, interpretation of results, reference selection or manuscript drafting. All authors critically reviewed and approved the final manuscript and remain fully accountable for its content. The tool was not considered an author.

**Results**

**Study population and participation**

144 participations were included in the primary analysis. These corresponded to 136 unique users. Eight users participated more than once.

Of the 144 participations, 93, 64.6%, occurred on 28th May and 51, 35.4%, on 29th May. All included participations had complete telemetry and survey data.

Overall, 93/136 unique users, 68.4%, had at least some previous exposure to gamified learning tools. However, only 42/136, 30.9%, reported using these tools several times or habitually (Table 1)

Regarding ToREIMC, 76/136 unique users, 55.9%, were potential new users because they either did not know the platform or knew it but had not used it. Only 16/136, 11.8%, reported habitual current or previous use.

**Table 1. Participant baseline exposure to gamified learning tools and ToREIMC among unique users**

| Variable                                       | n/N     | %    |
|------------------------------------------------|---------|------|
| Unique users                                   | 136/136 | 100  |
| <i>Previous use of gamified learning tools</i> |         |      |
| • Never                                        | 43/136  | 31.6 |
| • Occasionally/at least once                   | 51/136  | 37.5 |
| • Several times                                | 28/136  | 20.6 |
| • Habitually                                   | 14/136  | 10.3 |
| <i>Previous knowledge or use of ToREIMC</i>    |         |      |
| • Did not know ToREIMC                         | 45/136  | 33.1 |
| • Knew ToREIMC but had not used it             | 31/136  | 22.8 |
| • Had used ToREIMC occasionally                | 44/136  | 32.4 |
| • Used or had used ToREIMC habitually          | 16/136  | 11.8 |

### Time windows of maximum use

Participation was not evenly distributed across the congress period (Figure 1 and Table 2). The highest activity occurred around midday and early afternoon. The 13:00–14:00 h window accounted for 54/144 participations, 37.5%, and 53 unique users.

**Table 2. Participation and performance by local hour**

| Local hour | Participations | Unique users | Mean correct answers | Median time, seconds | Mean score |
|------------|----------------|--------------|----------------------|----------------------|------------|
| 09:00      | 1              | 1            | 4.00                 | 175                  | 337        |
| 10:00      | 12             | 11           | 5.25                 | 129                  | 432        |
| 11:00      | 11             | 10           | 5.91                 | 153                  | 452        |
| 12:00      | 18             | 18           | 5.78                 | 144                  | 472        |
| 13:00      | 54             | 53           | 5.91                 | 118                  | 507        |
| 14:00      | 23             | 22           | 5.52                 | 154                  | 458        |
| 15:00      | 13             | 13           | 6.77                 | 117                  | 581        |
| 16:00      | 4              | 3            | 8.75                 | 46                   | 819        |
| 17:00      | 6              | 6            | 6.50                 | 129                  | 547        |
| 18:00      | 2              | 1            | 6.50                 | 81                   | 588        |

The highest-volume half-hour interval was 13:00–13:30 h on 29th May, with 20 participations. Other high-volume intervals included 13:30–14:00 h on 28th May, with 18 participations, and 13:00–13:30 h on 28th May, with 14 participations.

From an engagement and recruitment perspective, the 13:00–14:00 h window was the most efficient because it combined the largest number of participants with substantial exposure to users who did not previously use ToREIMC. Smaller intervals such as 10:30–11:00 h and 14:30–15:00 h on 28 May had fewer participants but high proportions of users unfamiliar with ToREIMC.

### Knowledge performance and response speed

The mean number of correct answers was 5.95 out of 10, with a standard deviation of 2.28 and a 95% confidence interval of 5.58 to 6.33. The median number of correct answers was 6, with an interquartile range of 5 to 8 (Table 3 and Figure 2 for detailed Distribution of Correct Answers)

The mean final score was 501 points, with a standard deviation of 215. The median final score was 485 points. Median total response time was 132 seconds, corresponding to approximately 13.2 seconds per question. The interquartile range for total response time was 87.8 to 156.5 seconds.

### Table 3. Distribution of correct answers

| Correct-answer band  | n/N    | %    |
|----------------------|--------|------|
| 0–3 correct answers  | 17/144 | 11.8 |
| 4–6 correct answers  | 71/144 | 49.3 |
| 7–8 correct answers  | 38/144 | 26.4 |
| 9–10 correct answers | 18/144 | 12.5 |

Overall, 115/144 participations, 79.9%, achieved at least 5 correct answers; 84/144, 58.3%, achieved at least 6 correct answers; 40/144, 27.8%, achieved at least 8 correct answers; and 8/144, 5.6%, achieved the maximum score of 10 correct answers.

Participants with 8 or more correct answers had a median total response time of 75.5 seconds, compared with 141.5 seconds among those with fewer than 8 correct answers. Among participants with 9 or 10 correct answers, the median response time was 56 seconds, corresponding to approximately 5.6 seconds per question.

### Association between accuracy, speed and score

Final score showed a very strong correlation with the number of correct answers, with Spearman's rho of 0.976,  $p < 0.001$ . Final score was also inversely correlated with total response time, with Spearman's rho of -0.506,  $p < 0.001$ . Response time was inversely associated with the number of correct answers, with Spearman's rho of -0.377,  $p < 0.001$ . (Figure 3)

These findings indicate that the scoring system primarily captured knowledge performance, while response speed provided additional discriminatory capacity between participants.

### Performance according to prior ToREIMC use

Performance differed according to previous exposure to ToREIMC. Participants who reported habitual use had the highest mean number of correct answers and final scores (Table 4).

**Table 4. Performance according to previous ToREIMC use**

| Previous ToREIMC use                | n  | Mean correct answers | Mean score | Median time, seconds |
|-------------------------------------|----|----------------------|------------|----------------------|
| Did not know ToREIMC                | 49 | 5.45                 | 452        | 139                  |
| Knew ToREIMC but had not used it    | 31 | 6.06                 | 512        | 119                  |
| Had used ToREIMC occasionally       | 45 | 5.96                 | 506        | 134                  |
| Used or had used ToREIMC habitually | 19 | 7.05                 | 602        | 124                  |

Previous ToREIMC use showed a weak but statistically significant ordinal association with number of correct answers, with Spearman’s rho of 0.208, p=0.013.

Survey responses

Survey responses showed a favorable perception of the activity and of gamification as an educational approach (Figure 5). The highest-rated item was the usefulness of trivia-type questions to identify knowledge gaps, with a mean score of 4.44 and 86.1% agreement (Table 5).

Table 5. Post-activity survey responses

| Survey item                                                                        | Mean | SD   | Median | Agreement 4–5, % | Strong agreement 5, % |
|------------------------------------------------------------------------------------|------|------|--------|------------------|-----------------------|
| Gamification can improve learning                                                  | 4.33 | 0.78 | 5      | 80.6             | 52.1                  |
| Trivia-type questions help identify knowledge gaps                                 | 4.44 | 0.76 | 5      | 86.1             | 59.0                  |
| Competition increases motivation                                                   | 4.32 | 0.89 | 5      | 81.3             | 54.9                  |
| Gamification may trivialize complex clinical content                               | 4.03 | 1.11 | 4      | 71.5             | 45.1                  |
| I feel comfortable solving clinical questions                                      | 4.10 | 0.87 | 4      | 72.9             | 40.3                  |
| I feel able to apply microbiological concepts to clinical or therapeutic decisions | 4.13 | 0.87 | 4      | 75.0             | 41.7                  |

The internal consistency of the three educational acceptance items: perceived learning improvement, identification of knowledge gaps and motivation was good, with Cronbach’s alpha of 0.81. The two self-efficacy items: comfort solving clinical questions and ability to apply microbiological concepts also showed high internal consistency, with Cronbach’s alpha of 0.87.

When the trivialization item was reverse-coded and included in a global acceptance scale, internal consistency decreased to 0.46. This suggests that concern about trivialization may represent a distinct construct rather than the opposite of educational acceptance.

Discussion

Main findings

This cross-sectional telemetry and survey study evaluated a brief congress-based gamified challenge in Clinical Microbiology and Infectious Diseases. The activity was feasible, generated high participation during a short conference period and achieved complete survey capture among included participants.

More than half of unique users were potential new ToREIMC users, indicating that the intervention functioned not only as an educational challenge but also as a recruitment and dissemination tool.

The challenge showed adequate discriminatory capacity. Mean accuracy was approximately 6 out of 10, most participants clustered between 4 and 8 correct answers, and only 5.6% achieved a perfect score. This distribution suggests that the questions were sufficiently challenging for a professional audience and avoided a major ceiling effect. The time-weighted score performed as intended: accuracy was the dominant determinant of the final score, but response speed added meaningful discrimination, a useful property in competitive educational activities.

Survey responses were highly favorable. Participants perceived gamification as useful for learning, trivia-type questions as helpful to identify knowledge gaps and competition as motivating. Importantly, the survey also identified a critical tension: most participants agreed that gamification may trivialize complex clinical content. Rather than invalidating the intervention, this finding highlights the need to distinguish between superficial gamification and clinically rigorous gamified learning. In disciplines such as Clinical Microbiology and Infectious Diseases, the educational value of gamification likely depends on high-quality case construction, explanatory feedback and alignment with authentic clinical reasoning.

## **Interpretation in the context of existing literature**

Our findings are consistent with previous evidence suggesting that gamification and serious games can improve engagement and may enhance learning outcomes in health professions education [2–4]. The observed acceptability and motivational effect are aligned with systematic reviews reporting generally favorable learner responses to game-based or gamified interventions [4, 5]. However, our study contributes a different perspective by evaluating a real-world congress activity rather than a formal curriculum-based intervention.

The educational mechanism of the ToREIMC challenge may involve several complementary processes. First, the activity required retrieval of clinical and microbiological knowledge under time pressure. Retrieval practice is known to enhance long-term retention more effectively than passive restudy [5, 6]. Second, the immediate feedback model can help participants identify misconceptions and knowledge gaps. Third, competition and ranking may increase voluntary engagement, particularly in conference settings where attention is fragmented and multiple simultaneous activities compete for participation.

Consequently, within the Kirkpatrick's evaluation framework [7], our findings capture a strong Level 1 response (high acceptability and motivation) alongside immediate, cross-sectional indicators consistent with Level 2 learning-related performance (objective assessment performance and response telemetry). This dual pattern constitutes a promising, early educational signal rather than evidence of sustained learning outcomes. While performance was objectively measured, the absence of a pre-post design or delayed retention assessments means that this baseline evaluation supports the presence of learning-related engagement and performance, but does not demonstrate sustained knowledge acquisition, behavioural change, or patient-level outcomes.

# Implications for congress-based education

Medical conferences often concentrate highly motivated professionals but rely heavily on passive educational formats. A short gamified challenge may offer several advantages in this context. It can attract spontaneous participation, generate objective data, support social interaction, identify high-performing participants and expose attendees to educational resources beyond the congress itself.

The hourly distribution of participation has practical implications. The 13:00–14:00 h window, which was scheduled in the congress programme as a break, was the most productive period for overall engagement and recruitment. Notably, this time slot was slightly earlier than the usual sociocultural lunch time in Spain, suggesting that stand-based gamified activities may be particularly effective when aligned with structured transition periods, scheduled breaks or high-flow intervals, rather than with conventional meal times alone. In contrast, later lower-volume windows appeared to include participants with higher performance and faster response times, suggesting potential value for finals, expert duels or competitive showcases.

## Strengths

This study has several strengths. First, it combined objective telemetry with subjective survey responses. Second, all included participants completed the survey, eliminating missing data for perception outcomes. Third, the study was performed in a real-world congress environment, increasing ecological validity. Fourth, the intervention generated both educational and implementation-relevant outcomes, including engagement by time window and recruitment of new users. Finally, the survey captured not only enthusiasm for gamification but also concern about trivialization, providing a more nuanced interpretation.

## Limitations

The study also has important limitations. First, it was observational, cross-sectional and based on a convenience sample. Participants self-selected into the activity, which may overestimate acceptability and engagement. Second, there was no control group or non-gamified comparator, so the specific contribution of gamification cannot be isolated from the effect of testing, novelty or social interaction. Third, there was no pre-test, post-test or delayed assessment, which prevents conclusions about knowledge gain or retention. Fourth, participant characterization was limited; specialty, training level, previous expertise and congress attendance patterns were not systematically collected. Fifth, repeated participation by a small number of users may have influenced performance analyses, although unique-user counts were used for baseline exposure. Sixth, the survey was developed for this activity and was not externally validated. Finally, the concern about trivialization requires qualitative exploration, because Likert-scale data cannot determine which aspects of gamification participants considered potentially reductive.

## Future research

Future studies should incorporate stronger educational designs. A pre-post design would allow estimation of immediate knowledge gain, while delayed testing at 4 to 8 weeks would assess retention. A randomized or quasi-experimental comparator could distinguish the effect of gamification from standard case-based testing [8, 9]. Collection of educational baseline variables would allow subgroup analyses by specialty, training stage and prior exposure. Qualitative data could clarify how participants perceive competition, difficulty, feedback and trivialization. Finally, linkage between congress participation and subsequent ToREIMC use could determine whether brief gamified activities promote sustained engagement with continuing medical education.

## **Conclusions**

A brief congress-based gamified challenge in Clinical Microbiology and Infectious Diseases was feasible, highly accepted and effective in attracting both existing and potential new users of ToREIMC. The activity generated objective performance metrics, showed appropriate discriminatory capacity and was perceived as useful for identifying knowledge gaps and increasing motivation.

The central educational insight is that gamification was not perceived merely as entertainment. Participants valued its potential for learning and self-assessment, while simultaneously recognizing the risk of oversimplifying complex clinical content. This tension should guide future design: gamification in Clinical Microbiology and Infectious Diseases is most likely to be educationally valuable when it is anchored in rigorous clinical cases, immediate explanatory feedback and explicit learning objectives.

## **Declarations**

### **Ethics approval and consent to participate**

This study was reviewed by the ethics committee of Hospital Universitario de Navarra at Pamplona-Spain, which determined that formal ethics approval was not required for this retrospective analysis of anonymised educational telemetry and survey data collected during voluntary participation in a congress-based educational activity. The requirement for written informed consent was waived by the same committee because no identifiable individual participant data were analysed. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and applicable institutional and national regulations.

### **Consent for publication**

Not applicable. The manuscript does not contain identifiable individual participant data, images or videos.

### **Availability of data and materials**

A de-identified minimal dataset may be made available from the corresponding author on reasonable request and after approval by the study group and, where applicable, the relevant ethics committee.

## Competing interests

ABD developed and coordinate the ToREIMC educational platform. This represents a non-financial competing interest. The ToREIMC platform has received external sponsorship for development or maintenance; the sponsor had no role in the design of this study, data collection, data analysis, interpretation of results, manuscript preparation or decision to submit.

All other authors declare that they have no competing interests.

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## Authors' contributions

ABD, MRM, MMG and MMR conceived the study. MRM, JBR and ACV designed the educational activity. ABD, MRM, MMF curated the dataset. ABD, DGC, AVB performed the statistical analysis. ABD, MRM, MMG, JBR, ACV, MRM, MMF, DGC and MMR interpreted the results. ABD, MRM, MMG and MMR drafted the manuscript. . ABD, MRM, MMG, JBR, ACV, MRM, MMF, DGC and MMR critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

## Acknowledgements

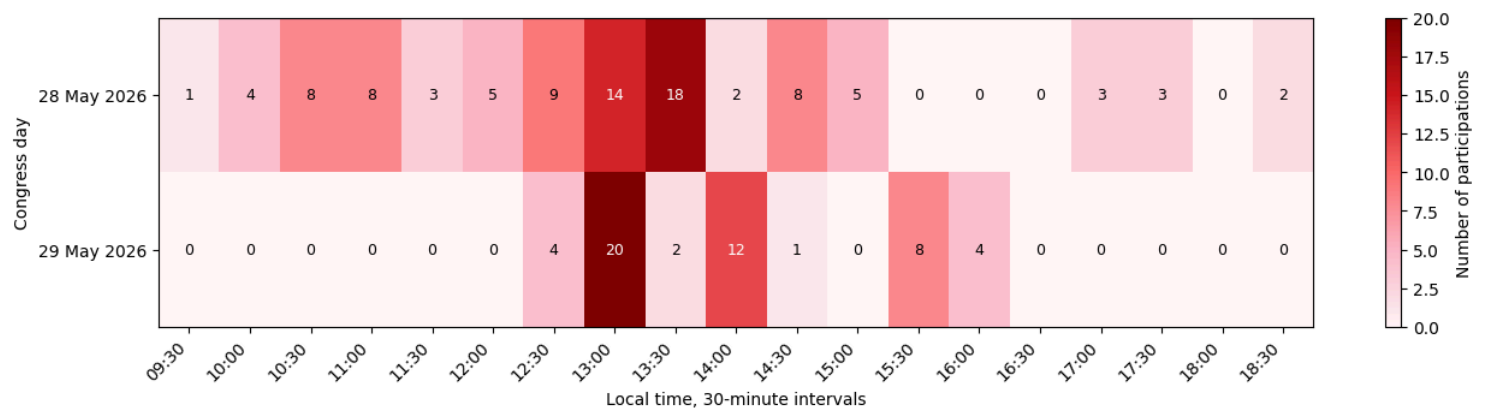
The authors thank all congress participants who took part in the ToREIMC challenge. The authors also thank Natalia Jiménez, Javier Ávila, Mónica Álvaro-Díaz and Alejandro Olleta for logistical support during the activity.

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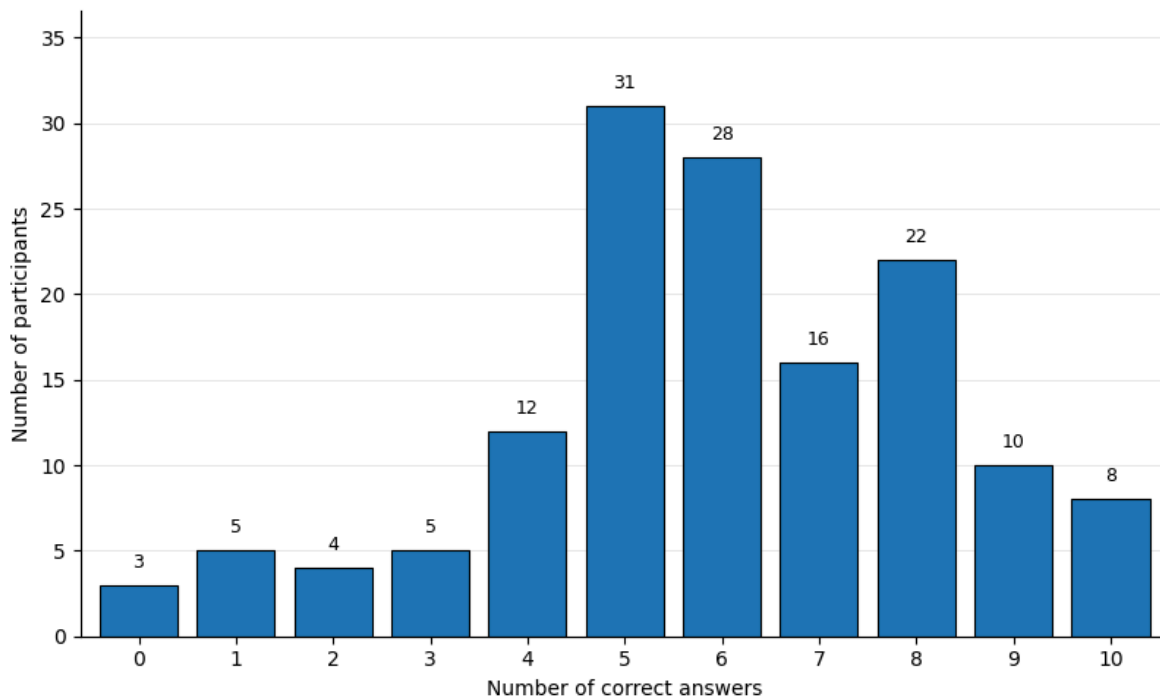
Figures



Heatmap based on the analytic dataset: 144 participations from 136 unique users, after excluding pre-congress records and invalid >10-answer test entries.

Figure 1

Participation by date and local time



Histogram based on the analytic dataset: 144 participations from 136 unique users, after excluding pre-congress records and invalid >10-answer test entries.

**Figure 2**

**Distribution of correct answers**

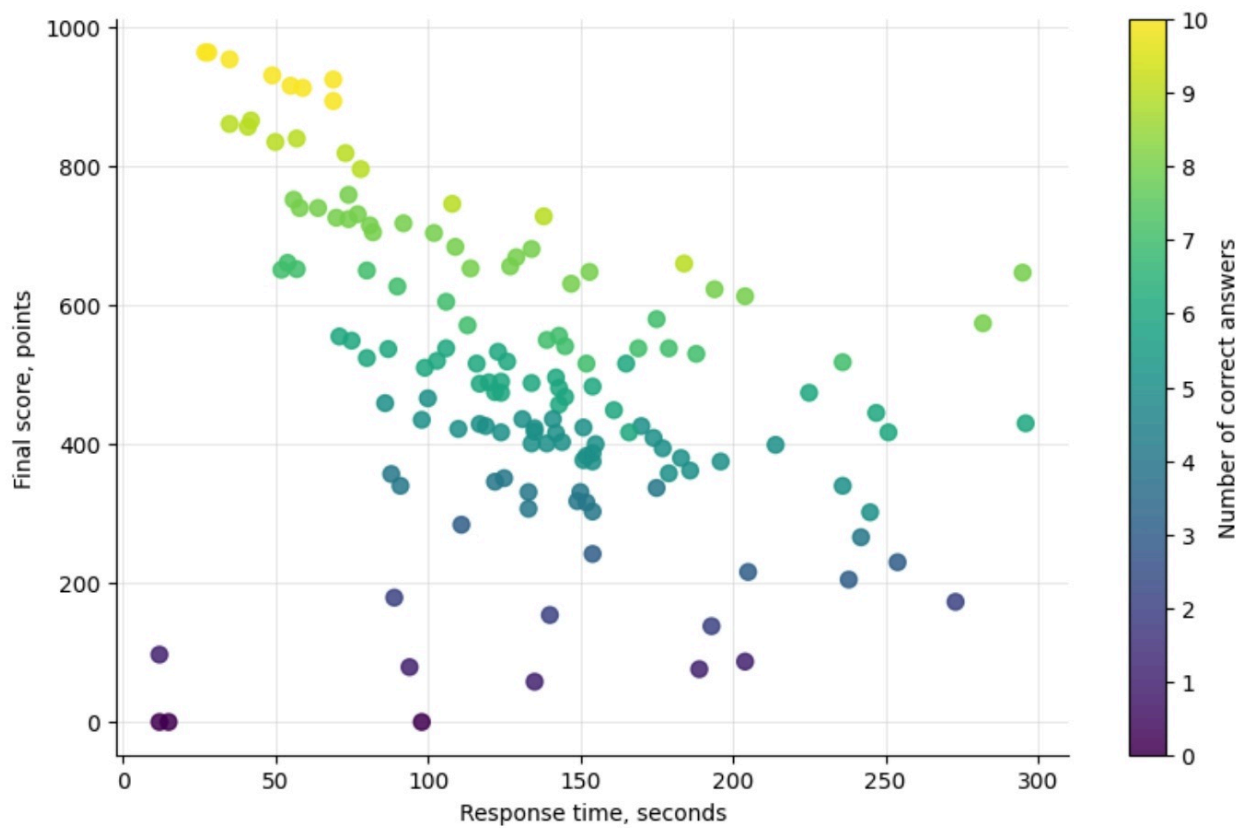


Figure 3

Relationship between score, accuracy and response time

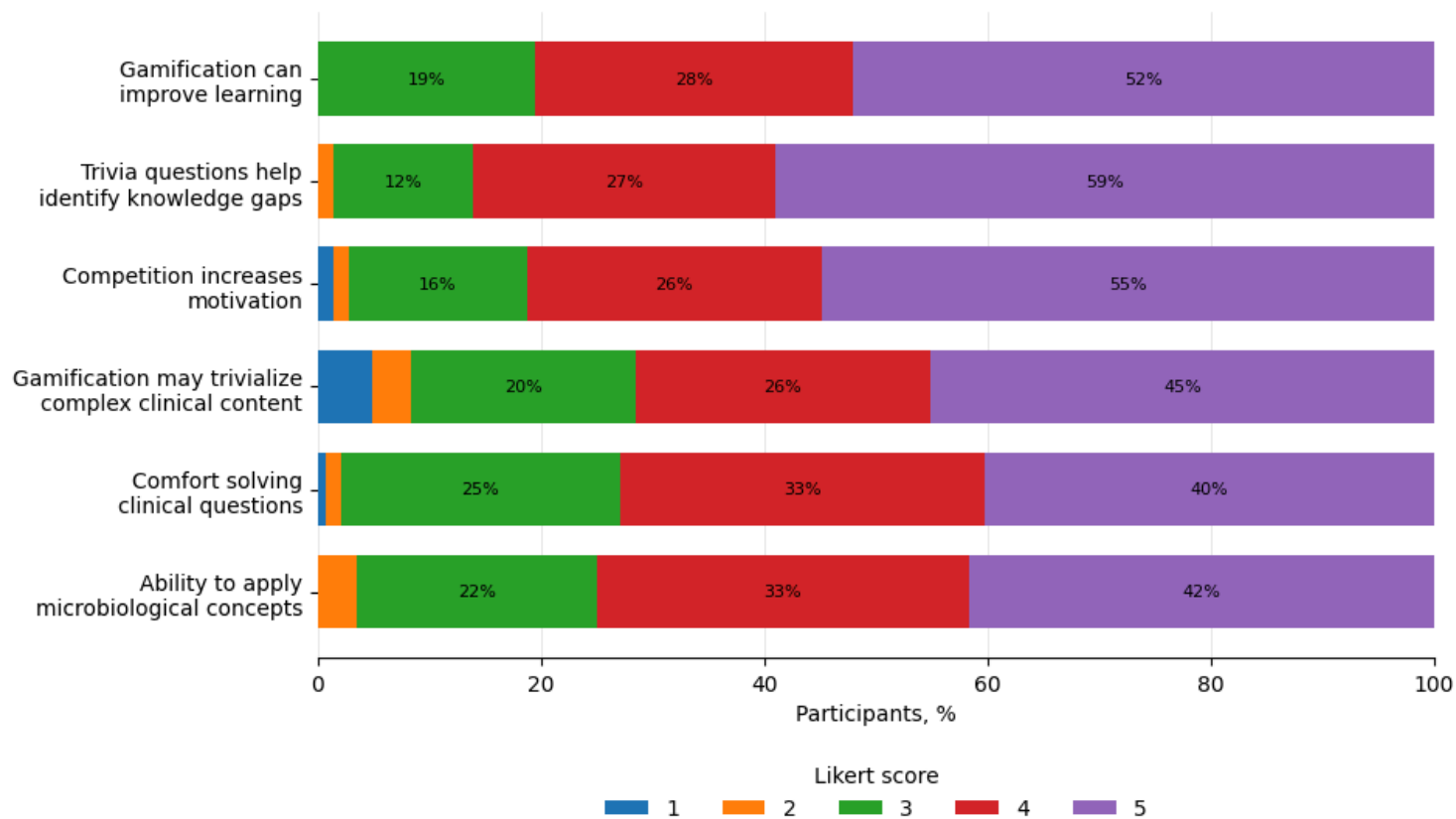


Figure 4

Figure 5. Likert-scale survey responses

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [supplementary.docx](#)