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Learn + Fun! Social Media and Gamification sum up to Foster a Community of Practice during an Emergency Medicine Rotation

Tiago de Araujo Guerra Grangeia[a], Bruno de Jorge[a], Dario Cecílio-Fernandes[b], Rene A. Tio[c,d], Marco Antonio de Carvalho-Filho[a,b,*]

[a]*Emergency Medicine Department, School of Medical Sciences, State University of Campinas (Unicamp), São Paulo, Brazil*

[b]*Center for Education Development and Research in Health Professions (CEDAR), University Medical Center, University of Groningen, Groningen, the Netherlands*

[c]*Catharina Hospital, Eindhoven, the Netherlands*

[d]*Department of Educational Development and Research in the Faculty of Health, Medicine and Life Sciences, Maastricht University*

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Abstract

Purpose: Medical students and clinical teachers thrive to establish meaningful learning relationships in overwhelmed and ever-shorter clinical rotations. The challenge for medical educators is to design pedagogical approaches capable of bonding students and teachers into the same community of practice (CoP). In this work, the authors explored how Social Media and Gamification strategies sum up to boost medical students' participation in a blended learning strategy to teach Emergency Medicine.

Method: Final year medical students ($n = 462$) from 5 consecutive years were included in a longitudinal study with historical controls and were divided into three groups. The first group (CONTROL; $n = 125$) had access to a blended learning strategy; the second group (FACE; $n = 179$) had access to the blended learning strategy and interacted with a fictional facilitator in Social Media; and the third group (GAME; $n = 158$) had access to the former strategies plus a gamification approach.

Results: Social media and gamification progressively increased students' participation in the online course as measured by the number of hours logged on from an average of 60 h in CONTROL to 87 h in FACE and 140 h in GAME ($P < 0.01$). There was a positive and significant correlation between students' grades on cognitive tests and OSCEs exams with the online participation. Both strategies nurtured students' sense of belonging to the community of Emergency Medicine and improved their self-regulation to study.

Discussion: Social Media and Gamification catalyzed the consolidation of a shared identity for students and teachers, which fostered the creation of a community of practice and increased the participation of students in learning activities.

Keywords: Community of practice; Social media; Medical education; Gamification

*Correspondence to: Departamento de Clínica Médica, Faculdade de Ciências Médicas, Universidade Estadual de Campinas (Unicamp), Rua Tessália de Vieira Camargo, 126, Cidade Universitária Zeferino Vaz, Campinas, SP, CEP 13083-887, Brazil.

E-mail addresses: macarval@fcm.unicamp.br, m.a.de.carvalho.filho@umcg.nl (M.A. de Carvalho-Filho).

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1. Introduction

Clinical teachers thrive to connect meaningfully to students in the ever-shorter clinical rotations.[1,2] The overwhelmed clinical environments demand a full commitment of health professionals to service delivery and then teaching activities can inflict an extra burden.[3,4] Moreover, generational changes challenge "Baby Boomers" and "Gen X" teachers to adapt to the "millennial" culture, in which relationships go ahead in the new online environment, with specific rules of engagement.[5–9] In this context, students often feel helpless, and find obstacles to build trusting relationships with their clinical teachers. The ultimate result is a fragile educational alliance, with a lack of opportunities to challenge students, to stimulate collaboration, and to deliver timely and efficient feedback.[2,10] Students do not judge themselves as "part of the team," and the consequence is the settlement of two different communities in the clinical environment: the community of students and the community of clinical teachers. The absence of connection hinders the development of productive interactions so crucial to foster the learning process in the workplace.[2,6] In this article, we explore how the communities of practice framework can ground the utilization of social media and gamification strategies to boost final year medical students' participation in a blended online Emergency Course.

According to Wenger, "Communities of Practice (CoPs) are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly".[11–13] Recently, Cruess et col.[14] suggested CoP as a potentially unifying framework for the field of medical education with the potential to guide pedagogical interventions that recognize the need for knowledge and skills acquisition to go hand in hand with identity development. Three main characteristics are essential to a learning community to be defined as a CoP: domain, community, and practice.[15–17] The domain refers to an area of targeted interest and shared passion, which comprises specific knowledge and routines. The community is the group which embraces a common identity, with shared values and goals. The practice comprehends a specific social repertoire of specialized actions and interactions cultivated by the community. In the context of CoPs, the creation of new knowledge relies on the regular interactions among people with different expertise levels, from senior participants to newcomers.[13]

As young craftsmen, CoP newcomers learn through observation and interaction with experts and colleagues.[11] Senior participants must figure out strategies to entrust newcomers, scaffold their development, and promote their autonomy in a process called legitimate peripheral participation.[18] As newcomers engage in regular activities, they develop a sense of belonging, which is crucial to creating a new identity committed to the practice, the norms and the values of the community.[12,13] According to CoP's theory, there are three main routes to foster the creation of that shared identity: *engagement* (doing things together); *imagination* (creating a shared image of the lived experiences); and *alignment* (contextualizing individual activities or ideas under a common perspective).[16]

CoP's framework can guide the learning process in the clinical scenario by acknowledging learning as a social enterprise, which demands meaningful and safe connections among supervisors and students.[16] Clinical teachers and students should not only perform clinical activities together but also protect a time to reflect side-by-side on the understandings and meanings of the practice. Unfortunately, fragmented rotations hamper the building of the communities, and teachers struggle to create a positive, efficient, and safe learning environment when the living time with students is insufficient.[2,10]

New technologies offer a light of hope to this dreadful scenario while offering a new space for dialogue and learning opportunities.[9,16] Millennial medical students feel safe interacting online.[8,9,17] The feeling of safety is related to mastering the online explicit and implicit socialization rules, which can evoke a sense of power over the teachers who are not digital natives.[7,8] This sense of power balances the teacher-student relationship, and medical students recognize and celebrate teachers' efforts to go online to interact in students' comfort zone. When teachers show, acknowledge and accept the vulnerable position of trying to adopt students' language, they create an opportunity for developing online trust, a crucial aspect of mentoring relationships based on the internet.[19]

According to Mayer[20] trust is "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party." Thus, trust needs three components to thrive: benevolence, integrity, and competence.[19] The controlled nature of the online environment allows teachers to devise learning interactions targeting these three components. Benevolence is acknowledged when teachers demonstrate an altruistic behavior committed to students' progress. Integrity refers to a coherence between words and acts when both are under the guidance of shared

values. Competence relates to teachers' proficiency to perform and supervise the learning tasks.[19]

Besides offering an opportunity for generating trust, the online environment can also extend the interaction time with students, and the teacher can decrease the cognitive load of tasks, tailoring the activities to student's knowledge levels in a stepwise approach from simple to complex problems.[21,22] As a blended strategy, online platforms also provide teachers the means to both equalize the learning opportunities and expose students to different clinical cases.[23–25] However, the online activities must attract and engage medical students who are often overwhelmed by various clinical and academic duties.[10,26] According to self-determination theory, engagement and intrinsic motivation are correlated and demand feeding students' universal needs of autonomy, competence, and relatedness.[27–30]

Social Media (SM) can increase the sense of relatedness and competence while offering new and creative ways to foster collaboration and co-construction of knowledge online, allowing regular interactions, even when people are geographically dispersed.[21,26,31,32] The advantage of SM over the traditional online approaches is to enable participants of a learning community to engage both in formal and informal activities.[33] The informal activities catalyze the sense of belonging of participants, which can nurture the consolidation of a shared identity. Although SM offers the tools, an experienced facilitator is crucial to guide the activities and the interactions towards the primary learning goals.[34,35] Just as the classroom needs its teacher, SM requires a skilled facilitator for active learning to occur.

In addition to Social Media, gamification strategies can also increase the engagement of students with academic activities.[36] Gamification is the process of adapting aspects of games to nongame-related activities, and involves three dimensions: abstraction, mechanics, and interface.[37–40] Complex real scenarios can be *abstracted* in multiple challenges, allowing students to focus on specific learning tasks, which can be displayed sequentially.[37,39] The *mechanics* of the game refers to the organization of the activity in different levels of complexity, which allows the students to reflect whether they have mastered the necessary knowledge/skills to progress to the next level of expertise.[37,39] The *interface* of the game can be designed to engage students and create a vibrant environment, which can be intrinsically rewarding.[37]

Gamification can bring several educational advantages, such as: providing clear learning goals, allowing self-monitoring of learning progress, tailoring activities to the level of students' expertise, creating opportunities to practice with extended time on task, and may even suppress the fear of failure.[36,37,40] There is scientific evidence available attesting the efficacy of gamification in increasing students' motivation and engagement.[36,37] Noteworthy, gamification concepts can be translated into simple initiatives, even without significant technological expenditure.[41]

In this work, we investigated both the influence of SM by creating a virtual character to act as an online facilitator and the implementation of a gamification strategy on students' engagement in an online platform within a blended learning emergency course. We hypothesized that both strategies would boost students' participation in online activities and catalyze the consolidation of a community of practice involving teachers and students. The study was a naturalistic experiment with a historical control. Our specific objectives were to determine: (1) The impact of the use of Social Media and Gamification strategies on the utilization of our online platform; (2) If there was a correlation of students' participation in our online course with their academic performance; and, (3) If the strategies implemented helped to create a community of practice of clinical teachers and medical students.

2. Methods

2.1. Subjects

We enrolled all Sixth-year undergraduate students from five consecutive academic years (2012–2016) at our University, $n = 462$. We grouped the students into the following cohorts:

A) Historical Control Group - CONTROL ($n = 125$; November/2011- April/2013) - this group had access to our regular Moodle-based course.
B) Facebook Group - FACE (n = 179; April/2013-April/2015) - beyond the Moodle-based course, the group interacted with a virtual character on Facebook (FB) who acted as a facilitator in an online CoP.
C) Gamification Group- GAME (n = 158; April/2015-October/2016) – beyond the Moodle-based course and the FB character, the group had access to a gamification strategy.

The three groups had similar characteristics regarding students' gender distribution and age. All the

students recruited followed the same selection process and curricular trajectories.

2.2. Educational context

In our medical school, the emergency medicine rotation is mandatory for 6th-year medical students and lasts two months, with a workload of 10 hours/day. In Brazil, recent graduated medical students are allowed to practice medicine independently, even without a residency training. After the graduation, most of the time, they work in primary care facilities and emergency departments. Therefore, our emergency rotation offers a concrete experience in emergency care, providing students opportunities to perform invasive procedures and to follow as many patients as possible. The rotation comprises two periods with four weeks duration in the following clinical environments:

A) Emergency Department (ED) - students have daily clinical rounds, shadow medical residents in the emergency room, independently attend patients in our outpatient clinic, and perform procedures, such as lumbar punctures, intubations, and central venous lines.
B) Emergency Ward/Intensive Care Unit (EW) - students have daily bedside clinical rounds, high-fidelity emergency simulation, simulation of medical encounters to foster empathy, clinical ethics meetings, clinical case discussions, a point-of-care ultrasound course, and a palliative care course.

In November 2011, we implemented a Moodle-based Emergency course, as a blended strategy, complementary to clinical activities. The online course is meant to support their learning; it is neither mandatory nor provides students with grades for participation. All the online activities are related to problem-solving and based on real clinical cases, and for a detailed description see Grangeia et al.[24] In this previous study, we described the development of our online course concept regarding the content, learning tasks, and tutor's work. We also described students' participation and academic performance.[21] In the current article, we show the follow up of this project focusing on the impact of using social media and gamification to foster students' participation.

2.3. The facebook character creation

In April 2013, we launched "Jacinto Bemelhor's" page on FB. The idea was to combine the best psychological characteristics of our clinical teachers ($n = 6$) in a unique personality: a competent teacher, superbly skilled on communicating with students; a joyful character who could help transform learning in a pleasurable experience. The name "Jacinto Bemelhor" was chosen to make a joke, trying to get students attention and approval. In Portuguese, the word "Jacinto" is a first name, but reads equals to "Já me sinto," which means "I am feeling" in English. The word "Bemelhor" is a contraction of "bem melhor" which means "much better." So, the English version of our character's name would be something like "Phil MuchBetter." In SM, humor can be a valuable and enjoyable form of reflective processing.[20]

A professional advertiser (BJ) helped to create "Jacinto's" concept. His inputs were critical to (1) employ an informal language in SM; (2) create "Jacinto´s" personality; (3) create a visual identity; and (4) increase the share of mind (the advertiser photographed some of our interactions with the students and uploaded selected images on Jacinto´s page on FB).

Jacinto's messages: All students in FACE and GAME groups were invited to become "Jacinto's friend" on FB. "Jacinto" advertises the new contents of our online platform sending messages to the students every time we uploaded new activities, which occurs on a daily basis. The messages ease the navigation through Moodle while directing students straightly to the new uploaded activities. "Jacinto's" messages are designed to be funny and to create a bond with emergency medicine as a discipline and emergency teachers. The daily messages had the same pattern to create a visual identity. We provide an example in Fig. 1.

After the creation of our character, students have two main routes to access our Moodle-based course: (1) FB links provided by "Jacinto"; or (2) login at our Moodle page. Using the FB links, students go directly to the login page after the first click and direct to the new activity after the second click. If they decided to log in to the Moodle platform, without using the FB links, they have to search for the activity, visiting at least five different pages, with four clicks. Therefore, the links reduced the cumbersome of connecting to the platform and searching for new the new uploaded activities.

Sense of Community: "Jacinto" developed several strategies to increase the sense of belonging through imagination. He created different playlists in Spotify® with the preferred songs of teachers and put the links on his FB page. He also created the "Jacinto's store," in which he posts some fictional products as t-shirts and cups, making jokes with his name (none of the products were really on sale – the idea was again to create a sense of a shared identity). "Jacinto's" page served as a

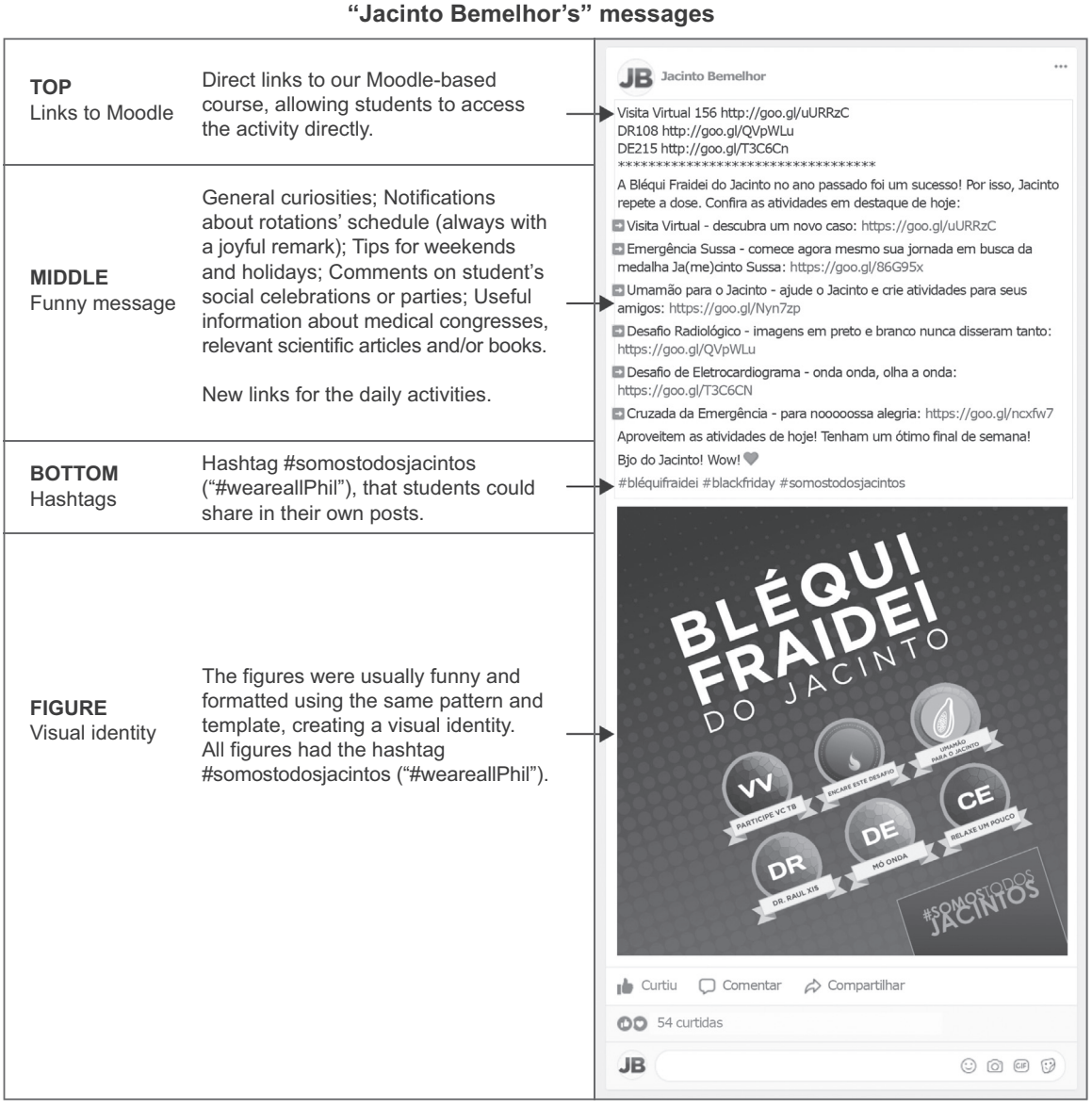

Fig. 1. Example of Jacinto´s message on Facebook. At the top, links to our Moodle-based course; at the middle, funny content related to academic or informal activities with links to the daily activities; at the bottom, hashtags related to the message; and a figure, always with the same pattern, creating a visual identity.

forum where students and teachers shared impressions, photos, and memories about daily activities, like meetings, classes, simulations and academic awards.

Jacinto's ethics: Although we used informal SM language and humor, all of "Jacinto´s" messages were ethical, aiming to increase the motivation for learning and show students how learning can be fun. Patients', students', and teacher's privacies were always respected, and unethical behavior was not tolerated. Fortunately, we did not have any incident. We respected the boundaries of student-teacher relationship in SM in the same way we respected it in the real world. Moreover, all online academic activities were developed on Moodle, and we did not discuss clinical cases on FB.

2.4. Gamification strategy

In April 2015, we launched our Gamification Strategy. The idea was to gather different activities in three consecutive study guides, named: "Emergency Cool," "Emergency Pro," and "Emergency Insane." Each

one of the guides comprehended sequential levels, with an increasing number of activities per level, providing the students the feeling of "leveling up" (an expression borrowed from games that indicates improvement and conquest). As soon as students finished one level, they had access to the activities of the next level, inside the same guide. We applied the same mechanics to the guides: students had to finish "Emergency Cool" to start "Emergency Pro" and finish "Emergency Pro" to start "Emergency Insane." The utilization of the guides was not mandatory, and all the activities were also independently available.

However, if the students decided to follow the guides, after completing each one of them, they won a funny virtual medal with their picture on it plus one of the following statements: "Ja(me)cinto Sussa" ("(*I*) *Phil* Cool"), "Ja(me)cinto Profissa" ("(*I*) P*hil* Pro"), or "Ja (me)cinto Insano" ("(*I*) *Phil* Insane"). We sent this medal to students through their FB page, and if students authorized, we published the medals on the "Jacinto Bemelhor" page. In Fig. 2, we show an overview of the gamification strategy.

Jacinto's Awards: At the end of the academic year 2016, students and teachers together organized the first "Jacinto's" Awards. All emergency medicine teachers, 70 last-year medical students, and several guests attended the event, which lasted 4-hours and was held at the University Theater. The event was filmed and live-broadcasted on FB, with great repercussion among the academic community. Students received awards (personalized tag cords, T-shirts and medals' certificates) for the completion of "Cool," "Pro" and "Insane" study guides. There were also prizes to the best answers in Moodle platform, the recordists in questions to Phil, among others. The event was full of artistic performances, mainly musical, with teachers and students performing together.

2.5. *Tutor´s work*

The tutor (TAGG) spent the same average of working hours (20 h/week) on the online activities for each one of the groups. Tutor's work comprehended the creation of the online content and the feedback to the

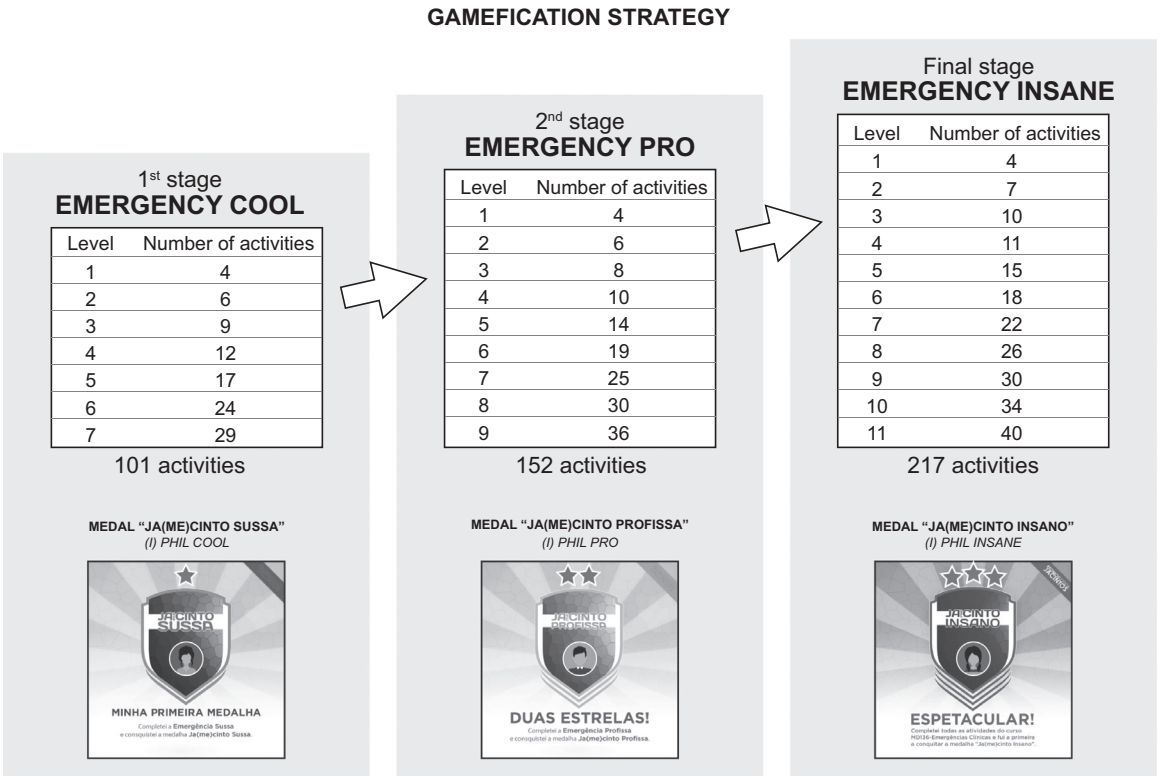

Fig. 2. Gamification Strategy. When students started using the guides, they had access only to the activities related to the Level 1 of Emergency Cool. As soon as they finished Level 1, they had access to Level 2, and so on until all levels of Emergency Cool were completed. Emergency Pro and Insane followed the same protocol. After finishing each stage (Cool, Pro, and Insane) students won a virtual medal that was published on Facebook after their approval.

students. The educational web designer (BJ) devoted an extra 10 hours/week of work for the FACE and GAME groups to develop: 1) the SM content in FACE and GAME groups; and 2) the gamification strategy in the GAME group. TAGG was also responsible for the daily clinical rounds at the Emergency Department and for the high-fidelity simulation activity (4 encounters with 3 hours duration). After implementing the FB strategy, TAGG and BJ had weekly meetings to create the FB content.

2.6. Ethical approval

The Ethics committee on human beings from the School of Medical Sciences of the University of Campinas (Unicamp) approved the research and deemed not necessary to get written informed consent of the participants. The main reasons were: our course was already curricular at that point, and only the main author had access to the non-anonymized data.

Number of approval: 2.114.958 (CAAE 66948617. 2.0000.5404).

2.7. Data Collection

2.7.1. Students' participation in our Moodle-based course

The data were obtained directly from the Moodle platform and categorized as follows: Logs – every page visited by students; Access - every login made by students; Hours Logged on – the total time students spent studying in the platform.

2.7.2. Facebook activity

We obtained general data on students´ participation, as numbers of likes, posts, and shares. The "Google URL shortener" counted every click on FB links.

2.7.3. Students' grades

Twenty-five students from CONTROL group and all students from FACE and GAME groups were submitted to two multi-dimensional assessments (one in the mid-clerkship and the other in the end-of-clerkship). The assessments relied on different items but had the same overall structure with:

A) Cognitive Test (CT): 50 multiple-choice plus 8 open-ended questions;
B) OSCE: 4 stations designed to assess students´clinical reasoning and professionalism (3 stations) and procedural skills (1 station).
C) Teachers' and Self- Assessment of Attitudes and Behaviors (AAB): Teachers and students used a global rating scale developed to assess students' atitudes and behaviors during clinical activities. The rating was based on an observation period of 20–30 days. The scale has 10 items grouped in three main factors/domains: clinical skills, professional behavior, and empathy. At least, two different teachers graded each student in both rotations (ED and EW).

The remaining 100 students of the CONTROL group had the same number of assessments, but with a different strategy; therefore, we excluded these students from the data analysis regarding the utilization of the platform and academic performance.

2.7.4. Students' online survey

At the end of 2016 we did a survey with students of FACE and GAME groups (n = 337) to understand the impact of the creation of the character and the medals on students' behavior. To both groups we sent a survey to explore their reactions to the FB strategy and to the GAME group we also sent a survey to explore the reactions to the Gamification strategy. Ninety-two students (27.2%) responded our questionnaire. The online survey comprehended 20 items regarding SM and Gamification strategies in a Likert format (from 1 to 5; 1 = completely disagree; 5 = completely agree). The questionnaires also had two open-ended questions. For a detailed description of the questionnaires, see Appendix A.

2.8. Data analysis

2.8.1. Students´ study pattern during emergency rotation

To compare the difference between groups regarding Logs, Access and Hours Logged on, we conducted a repeated measure ANOVA.

2.8.2. Academic performance

First, the Hours logged on were divided into quartiles. Subsequently, we conducted an ANOVA using the quartiles as groups and the average grades on cognitive tests or OSCE exams as independent variables, to investigate whether students' that spent more hours logged on the platform also achieved higher grades on the cognitive test or the OSCE. Finally, to examine whether there was a difference in between the FACE and GAME groups on the average grades on cognitive tests and OSCE exams, we conducted an independent sample T-test. We used

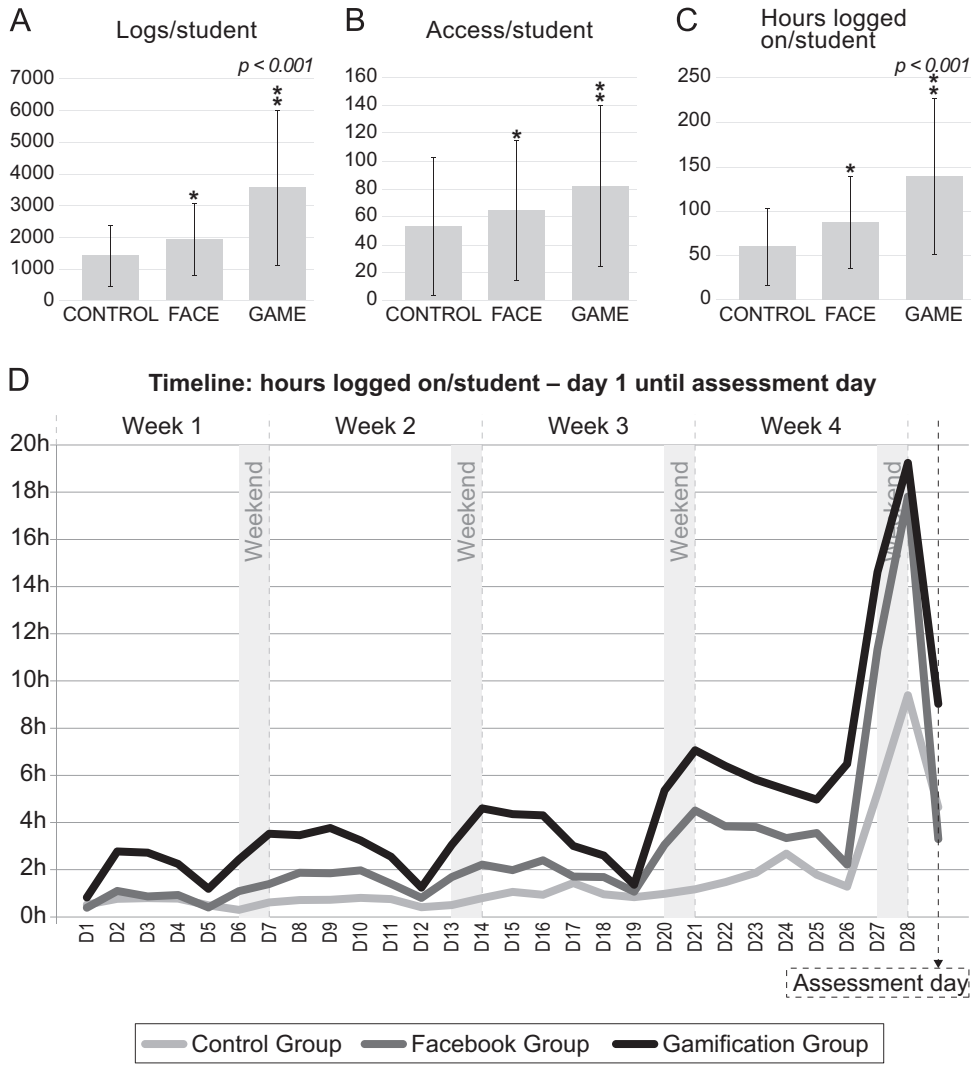

Fig. 3. Number of Logs, Access and Hours logged on per student (average ± SD). Bars indicate standard deviation. 3A) Logs/student: CONTROL (1441.41 ± 49.5), FACE (1960.37 ± 1152.21) and GAME (3569.07 ± 2451.59) groups. 3B) Access/student: CONTROL (53.42 ± 49.5), FACE (64.13 ± 54.10) and GAME (81.65 ± 57.95) groups; 3 C) Hours Logged on/student: CONTROL (60.38 ± 43.39), FACE (87.51 ± 51.26) and GAME (139.52 ± 88.39) groups. 3D) Average number of hours logged on/student from Day 1 until the assessment day for CONTROL, FACE and GAME groups (week 1/week 2/ week 3/ week 4 – GAME > FACE > CONTROL – $P < 0.01$). ** = $P < 0.01$ GAME > FACE/GAME > CONTROL. * = P < 0.01 FACE > CONTROL.

Spearman's correlation coefficient (r) to correlate hours logged on with the AAB assessment in FACE and GAME groups.

2.8.3. Survey analysis

To investigate whether "Jacinto" creation and the gamification strategy helped to create a community of practice of clinical teachers and students, we analyzed students' answers to the Student Satisfaction Survey. The closed questions were described in percentages. The content of the open-ended questions from the students´ survey underwent thematic content analysis, through the lens of the Communities of Practice framework and after exhaustible material reading. Three researchers (TAGG, BJ, and MACF) independently read all the answers to become familiar with the data and developed an initial open coding. The analysis progressed iteratively, and the authors grouped the codes in meaningful themes. The authors intentionally focused the analysis on the modes of belonging (engagement, imagination, and alignment), searching for aspects related to students' relationships with the clinical teachers, the character, the online activities, the strategies, and the rotation as a whole.

3. Results

3.1. Platform utilization

The total number of students participating in the study was 462, 270 (58.4%) women and 192 men (42.6%), with an average of 26.4 years-old. Both the creation of the FB character and the gamification strategy had positive and significant impacts on students' usage of the online platform. Fig. 3 shows the average number of logs (Fig. 3A), access (Fig. 3B) and hours logged on per student (Fig. 3C) in each group. All parameters of students' utilization increased along the groups (GAME > FACE > CONTROL, $P < 0.01$).

In Fig. 3D, we show a condensed timeline with the average number of hours logged on/student for all groups from the first day until the assessment day, considering every half of the emergency rotation. The graph shows the progressive enhancement in students' participation during the weeks preceding the assessment in all groups. Both strategies, FB, and gamification increased students' participation in all weeks, and not only immediately before the tests (weeks 1–4: GAME > FACE > CONTROL – $P < 0.01$).

For the subsequent analysis, we focused on hours logged on, as we find it the most relevant parameter to compare with academic performance.

3.2. Impact of platform utilization on academic performance

The relation of online activity with academic performance is shown in Fig. 4, including data from all students who were submitted to the same assessment strategy (FACE and GAME entire groups; 25 students of the CONTROL group). Fig. 4A and B show a progressive rise in cognitive and OSCE average grades

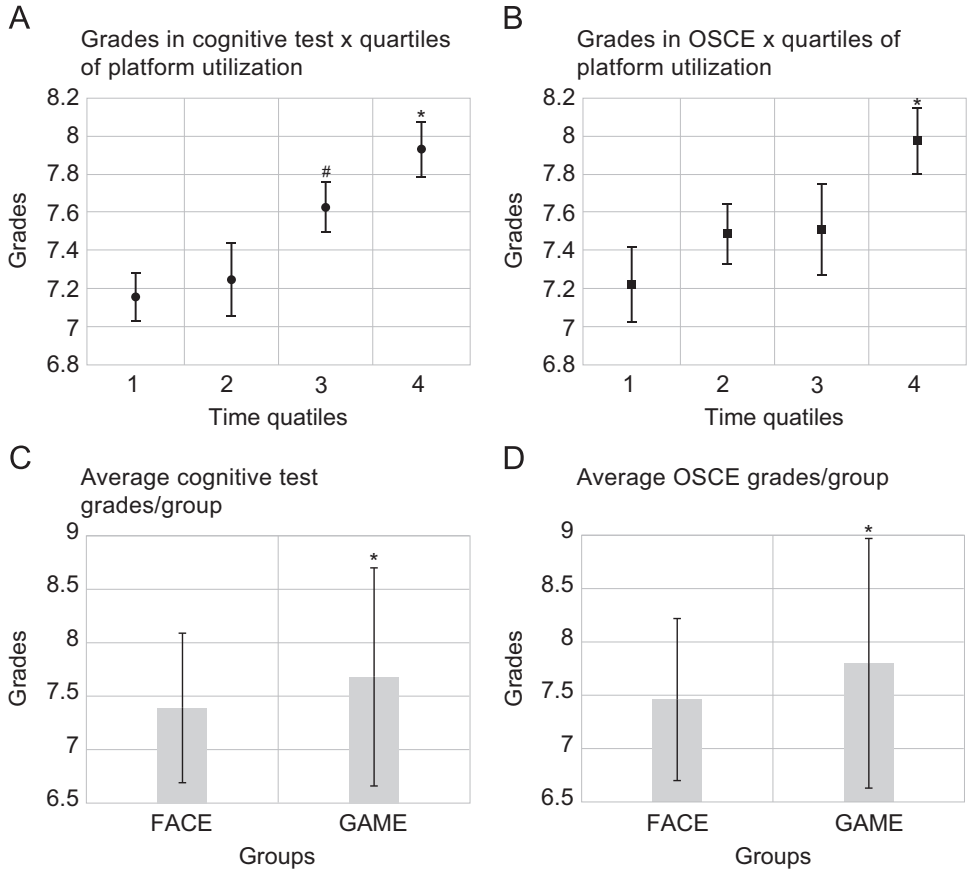

Fig. 4. 4A – Average grades in cognitive test x quartiles of platform utilization (hours logged on); * 4th quartile > 3rd, 2nd, and 1st quartile, $P < 0.01$; 3rd quartile > 2nd and 1st quartiles and < 4th quartile, $P < 0.01$; 4B – Average grades in OSCE exams x quartiles of platform utilization (hours logged on); * 4th quartile > 3rd, 2nd, and 1st quartile, P < 0.01; 4C - Average grades in cognitive tests in FACE and GAME groups; * GAME > FACE, $P < 0.01$; 4D – Average grades in OSCE exams in FACE and GAME groups; * GAME > FACE, $P < 0.01$.

from the first quartile of hours logged on towards the fourth. Fig. 4C and D show that students in the GAME group scored higher on average both in cognitive tests and OSCE exams when compared to the students in the FACE group.

We did not find strong correlations between AAB scores and the number of hours spent online in FACE ($r = 0.16$, $P = 0.02$) and GAME ($r = 0.02$, $P = 0.76$) groups.

3.3. Facebook activity and medals

All students in FACE and GAME groups agreed to become "Jacinto's" friends and regularly received his messages. After the beginning of the SM strategy, FB links became the main route to access our platform (59% of the accesses).

During all study time, "Jacinto" posted 718 messages to students. For students in the FACE group, "Jacinto" posted 374 messages, that were liked 3335 times (average of 8.92likes/post) and commented 220 times. For students in the GAME group, "Jacinto" posted 344 messages that were liked 4598 times (average of 13.37likes/post) and commented 200 times. The majority of students (84.3% in FACE and 89.8% in GAME groups) interacted regularly with "Jacinto" on FB.

"Jacinto´s" page on FB became a forum, in which students shared their academic activities and achievements, such as participation in national and international medical congresses. Students also tagged "Jacinto" in many personal activities (150 times), mainly during vacations and social encounters with other students. Students invited "Jacinto" to their parties and celebrations, notably their graduation day.

In the GAME group ($n = 158$), 61 students won the medal "Ja(me)cinto Sussa" ((I)IPhil Cool); nine students won the medal "Ja(me)cinto Profissa" ((I)Phil Pro); and one student won the medal "Ja(me)cinto Insano" ((I)Phil Insane).

3.4. Students survey

The students who answered to the survey (92–27% of GAME and FACE groups) had the same distribution regarding gender, age, online engagement, and aca-

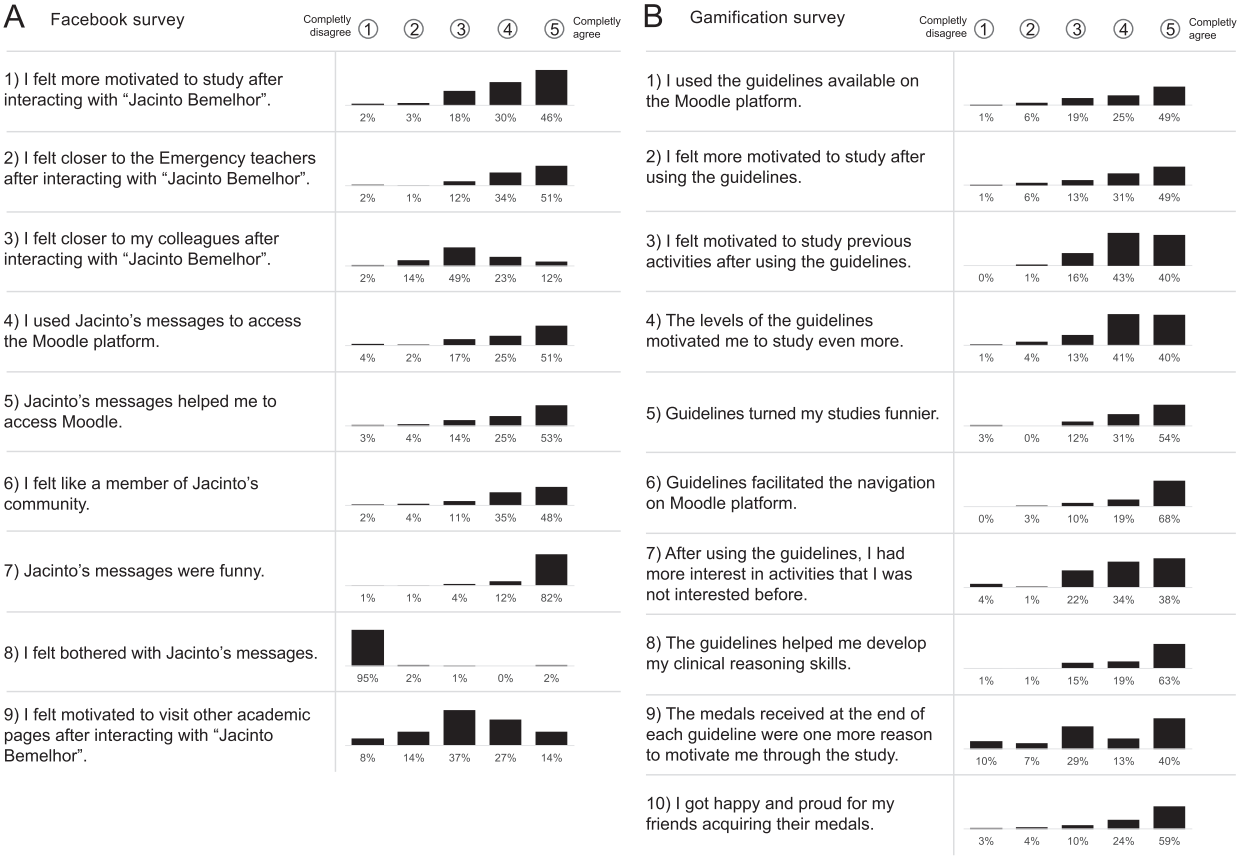

Fig. 5. Results of the online survey. For each question, students responded using a Likert Scale (1 = completely disagree to 5 = completely disagree). A – Facebook survey; B – Gamification survey.

demic performance when compared to the whole group of students.

Fig. 5 shows the quantitative results of our online survey regarding Social Media (Fig. 5A) and Gamification (Fig. 5B) strategies.

In the thematic analysis, we observed that students' remarks regarding Social Media and Gamification strategies were extremely positive. After reading the open-ended questions of both surveys, the researchers identified three themes that can help to understand the observed enhancement in students' participation: increased sense of belonging, improvement of self-regulation to study, and studying as a potentially entertaining activity.

The sense of belonging improved as the students got closer to "Jacinto" and valued him as a useful tool to help to study and connect.

> ""*Jacinto*" *is crucial for our interaction. He is our partner, our social media friend, and he makes everything more natural and funny! The Moodle and* "*Jacinto*" *are good examples of how it is possible to make the learning process more dynamic and enjoyable, and when it is done like that, it becomes much more solid. Thank you very much* "*Jacinto.*" *Thank you very much to all my beloved emergency teachers and emergency medicine team! I love you!*"

Students felt that the online interaction catalyzed by "Jacinto" helped the real-life interactions.

> "*The virtual interaction causes a greater involvement of the students with the teachers/staff members and with the rotation itself, stimulating students' to participate and study. Indeed, it becomes a regular topic of conversations with our friends and our colleagues who are in the same rotation. Do not stop ever!!! I am already missing you!!!*"

The gamification strategy shortened the generational gap between teachers and students.

> "*For a generation that has often been shaped by video games and quest systems or missions within RPG games, seeing a platform of one discipline following these moulds is a great encouragement to feel part of it and complete its steps. Recognition for doing so is a welcome bonus and encourages us always to try to go a little further. An open door for competitive people.*"

"Jacinto's" messages helped students to balance studying time with leisure time online, remembering them to study. His messages also facilitated the utilization of the platform and improved their self-regulation to study.

> "*Jacinto helps a lot because sometimes we are wasting time on Facebook, then we see a new post, and we get motivated to study! I always have accessed Moodle using* "*Jacinto's*" *links, because it was much simpler.*"

Following the guides made students more confident to deal with the real clinical tasks during the shifts.

> "*The study guides were excellent and helped me a lot to systematize the clinical reasoning and not let serious cases go unnoticed during the (real) shifts!*"

Students valued "Jacinto's" funny tune, which helped to motivate them to study.

> *"When interacting with the FB, the access became less serious, more pleasurable and more* "*daily."*

4. Discussion

Our work shows that Social Media (SM) and Gamification strategies were effective tools to boost students' participation in an e-learning platform. The FB character played the role of connecting teachers with the new generation of students, while the gamification strategy offered motivational rewards, as simple as a badge, but undoubtedly effective. Moreover, students' who were more active online had the higher grades, both in cognitive assessments and OSCE exams. The survey data confirmed our hypothesis that both strategies worked additively to nurture the creation of a CoP involving teachers and students; a CoP that started online and impacted on onsite activities. Our data also allow us to speculate that students' studying habits became more independent from the extrinsic motivation provided by assessments, as we can see through the weekly utilization of the platform.

We believe our results are worth exploring through 3 different lenses: (1) the CoP conceptual model, mainly focusing on the modes of belonging (engagement, imagination, and alignment);[16] (2) the concept of online trust and the importance of assuring competent advice, integrity, and benevolence;[19] and (3) the Self-determination theory (SDT) and the universal needs of autonomy, competence, and relatedness to foster intrinsic motivation.[27,28] The strength of our initiative is the synergistic use of different theories to create a meaningful and successful blended learning strategy.

The consolidation of a CoP demands the creation of a shared identity. In short rotations, time is a precious

commodity, and clinical teachers feel the pressure to deliver as much knowledge on their specialties as possible. However, if we want to use CoP as a framework in medical education, we must understand that creating a shared identity demands for strategic planning. In this regard, a CoP facilitator can actively foster activities devoted to improving the sense of belonging of participants.

Our FB character acted as the perfect facilitator. "Jacinto" earned students' trust and was accepted as "one of them". The FB character had daily contact with students, always showing a positive attitude, a commitment to students' well-being, and an unshakable faith in the improvement of students' performance. Our qualitative data showed that students testified the coherence between "Jacinto's" words and teachers' acts, which shortened the hierarchical and generational gap to the point they finally felt like a team member, as "one of us." Teachers lent their attested clinical competency to the character, and his remarks were always reliable, but also polite and respectful. "Jacinto" introduced students to teachers' positive intentions, values, coherence, and expertise, allowing the trust to flourish.

"Jacinto" also mastered the communication with Millennials, and his multifaceted personality provided students with several identification opportunities. Furthermore, "Jacinto" was passionate about medicine and medical education, but was also funny, modern, trustful and an expert in delivering feedback; All characteristics pushing students to adopt a feedback-seeking behavior.[19,42] Jacinto's page on FB turned into a virtual learning space, in which students and teachers could creatively, joyfully and above all, ethically, amplify and reflect on the learning experiences occurred during the Emergency Medicine rotation. The appealing approach of the character attracted students, who counted on Jacinto's messages to remember them to study without feeling the burden of "having to study." Moreover, the share of mind warranted by Social Media provided students with opportunities to imagine themselves as part of the team: A team with shared purpose and goals.

Social Media interactions amplified the possibilities for students and teachers to know more about each other and, consequently, find common professional and personal interests. The dialogues started online continued onsite, and vice-versa, enhancing the sense of familiarity, which is crucial for creating a shared identity. Although the emergency teachers were not formally interviewed, they agreed that the FB interactions helped them to remember their own experiences and struggles as novices, which helped teachers to connect with students in the real clinical scenario, shortening the generational gap. The bond with students crossed the boundaries of the professional setting, and the initiative of Jacinto's Award ceremony with musical performances with the simultaneous participation of students and teachers is the ultimate proof of this connection.

The gamification strategy summed up with the SM strategy to feed the basic needs of competence, autonomy, and relatedness, fomenting students' intrinsic motivation. Leveling up in a game triggers the feeling of competence, as you finish one step and gets ready for the next. In our strategy, the knowledge constructed in one step was essential to perform at the next level, intentionally creating a feeling of progressive cognitive autonomy. Also, real clinical cases grounded all online activities, and students realized that solving real problems online capacitated them to solve the same kind of problems on real shifts. Although we do not have direct proof, we believe that the recognition of new competencies by clinical teachers fostered the entrustment of students, increasing their autonomy to perform new activities in real clinical scenarios. In other words, when it comes to clinical activities, we believe that competence and autonomy go hand in hand, i.e., as students demonstrate more competencies, they earn more autonomy from their teachers.

Students valued teachers' efforts to speak their language, both creating the character on Social Media and applying gamification concepts to learning activities. When crossing the border towards students' world, teachers showed how motivated they were to come aboard and engage in meaningful learning. The consolidation of a positive relationship with students fulfills the need of relatedness while paving the way towards feedback acceptance and efficiency. Furthermore, both strategies brought fun to daily academic activities. Laughing, talking and solving problems together, students and teachers ended up in the same boat, sailing in the same direction, the same troubled waters of emergency care.

Our study has several limitations. It was performed in Brazil, which has a culture that actively values joy as a fundamental component of social activities. We cannot judge how this cultural background influenced the positive outcomes of both initiatives. The teacher who was responsible for the design of the online activities worked 20 hours/week in the creation of the content and counted on the assistance of a professional advertiser. Most academic settings cannot support this kind of dedication for all online strategies. Just 27% of

students of FACE and GAME answered our online survey. Finally, an observational study cannot define causal relationships, so we cannot exclude other factors influencing the students' behavior. Nevertheless, the real educational and clinical settings are seldom controlled environments.

5. Conclusion

Social Media and Gamification can be used to boost the creation of a shared identity for students and teachers, which can accelerate the consolidation of a community of practice and increase the participation of students in learning activities. The new generation of students benefits from creative approaches to teaching, particularly the ones that embody the new communication tools familiar to Millennials.

Note on contributors

Tiago de Araujo Guerra Grangeia, MD is a clinical teacher, an emergency physician, and a PhD candidate (Medical Education) at the School of Medical Sciences - State University of Campinas (Unicamp), São Paulo, Brazil.

Bruno de Jorge is an advertiser and educational web designer at the School of Medical Sciences - University of Campinas (Unicamp), São Paulo, Brazil.

Dario Cecilio-Fernandes is a psychologist and Ph.D. candidate (medical education) at the Center for Education Development and Research in Health Professions (CEDAR), University Medical Center Groningen, Groningen, The Netherlands.

Rene A Tio, MD, PhD, is a Cardiologist at Catharina Hospital, Eindhoven, The Netherlands.

Marco Antonio de Carvalho-Filho, MD, PhD, is Associate Professor at the Emergency Department of the School of Medical Sciences - State University of Campinas (Unicamp), São Paulo, Brazil, and research fellow in medical education at the Center for Education Development and Research in Health Professions (CEDAR), University Medical Center Groningen, Groningen, The Netherlands.

Ethical approval

The Ethics committee on human beings from the School of Medical Sciences of the University of Campinas (Unicamp) approved the research and deemed not necessary to get written informed consent of the participants. The main reasons were: our course was already curricular at that point, and only the main author had access to the non-anonymized data. Number of approval: 2.114.958 (CAAE 66948617.2.0000.5404).

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Declarations of interest

The authors report no conflict of interests.

Appendix A

1. Facebook survey:

1) I felt more motivated to study after interacting with "Jacinto Bemelhor";
2) I felt closer to the Emergency teachers after interacting with "Jacinto Bemelhor;
3) I felt closer to my colleagues after interacting with "Jacinto Bemelhor";
4) I used Jacinto´s messages to access the Moodle platform;
5) Jacinto's messages helped me to access Moodle;
6) I felt like a member of Jacinto´s community;
7) Jacinto's messages were funny.
8) I felt bothered with Jacinto's messages.
9) I felt motivated to visit other academic pages after interacting with "Jacinto Bemelhor".

The Facebook survey also had an open-ended question: "What you can tell us about "Jacinto" and Facebook as a complement to your daily activities in the Emergency rotation?".

2. Gamification survey:

1) I used the guidelines available on the Moodle platform;
2) I felt more motivated to study after using the guidelines;
3) I felt motivated to study previous activities after using the guidelines;
4) The levels of the guidelines motivated me to study even more;
5) Guidelines turned my studies funnier;
6) Guidelines facilitated the navigation on Moodle platform;
7) After using the guidelines, I had more interest in activities that I was not interested before;

8) The guidelines helped me develop my clinical reasoning skills;
9) The medals received at the end of each guideline were one more reason to motivate me through the study;
10) I got happy and proud for my friends acquiring their medals.

The Gamification survey also had an open-ended question: "What you can tell us about Study Guides and Badges of our Course?".

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