Interactivity and learning through gamification, clinical rounds and virtual labs

Carlos Danilo Cardoso Matos Silva
Master in Biotechnology, professor and researcher at the University of Excellence (UNEX).
E-mail: carloscardoso.fsa@gmail.com

Marcus Vinicius Cardoso Matos Silva
Master in Genetics, professor and researcher at the University of Excellence (UNEX).

ABSTRACT
Learning is a complex process, which involves several external factors such as the physical environment, institutional culture, assessment requirements, among others, and internal factors such as personal motivation, guidance in the learning process, individual conception of knowledge. The concept of learning refers to the acquisition or construction of knowledge or the development of skills and attitudes as a result of educational experiences such as classes, readings and research. The options for using active teaching-learning methodologies are numerous in the health area, whose integration between theory and practice fostered through active methodologies launches a new horizon of training possibilities, which becomes more solid and effective what is known for meaningful learning. The relationship with reality, as in the practice carried out in the virtual laboratory, facilitates the fixation of contents and promotes the development of critical thinking. The formative potential of the active methodology configures an important teaching strategy for health professionals, based on the expectation of accentuated autonomy, it is expected that they will be able to solve problems through a global analysis of the context of each case, as it happens in clinical rounds. The challenge facing teachers is to look for didactic tools that can be used in the classroom to make the educational environment increasingly dynamic and attractive, such as proposals that involve pedagogical games (gamifications), which help to increase level of interest and concentration in activities, communication, motivation and interactivity of students.

Keywords: Methodologies, Teaching-learning, educational strategies.

1 INTRODUCTION

The use of technologies in education enables many reflections frequently, either from the methodologies that use them as the focus of the study or the effect that the use of these technologies causes in the teaching/learning process. In the traditional teaching model, students have the habit of remaining static, concentrating on doing activities for a long period of time, always repeating the cycle classes-exercises-tests, which is not always pleasurable. It is worth mentioning that learning, in addition to cognitive skills, also depends on the student's personal motivation to develop other skills such as the ability to persevere, to deal with frustrations (self-control) and to reflect on their actions and expectations.

In an educational intervention with pedagogical potential the contents must be placed in such a way that they are meaningful and functional to the students, especially during this time of pandemic, provoking cognitive conflicts and promoting mental activity. Thus, it is necessary to think, both about situations arising from teacher-student-scientific knowledge interactions, and the treatments that

should be applied to the specific contents that are intended to be taught (ZABALA, 2003). Learning needs to be faster, interactive, engaging and fun to follow the behavior of the new generation (ALVES, 2014).

For the *Association for Educational Communication and Technology* (EGTC, 2008), educational technology is the study and ethical practice of facilitating learning and improving performance through the creation, use and organization of technological processes and resources. Within this perspective, the teacher has the role of choosing and evaluating the tools for use in teaching, launching technologies or applications that seek to facilitate the construction of knowledge, collaboration and articulation among students. A relevant aspect is that conversation and critical thinking are stimulated and developed as cognitive tools, which provide individuals with conditions for the development of differentiated learning situations. Academics are increasingly present in environments where technology and digital media stand out, and new approaches and strategies are needed to influence students during this pandemic process, as they are discouraged and unmotivated in relation to the learning methodologies used in some educational institutions.

The development of new ways to share information and internet technologies have facilitated the emergence of a variety of remote learning scenarios today. However, in technological areas such as healthcare, where students must perform practical exercises and laboratory work essential for learning, it is not so easy to design online environments for practice. Therefore, the purpose of this chapter is to describe the process of adopting an online learning environment during this pandemic period by incorporating internet-based resources such as virtual labs, interactive activities (clinical rounds), and a game-based learning methodology (gamification).

Among these methodologies, gamification, from the English *Gamification*, has been gaining national prominence due to its ability to involve, engage and motivate the action of the student in learning environments. It is based on the use of game elements in other productions, in which greater motivation is sought, as well as user engagement. Being that the results are quite positive, indicating efficiency, fun and degree of satisfaction of the students with this model of remote teaching.

Contemporary society is strongly influenced by digital culture, digital games are inserted into social habits and gamification emerges as an element for the daily life of formal spaces of education. The goal of this technique would not be to "teach with the games", but to use its elements in a way that can promote motivation and involvement of students. Gamification, therefore, would be the elaboration of systematic models, focusing on people, from the logic of games, so it is important to seek to understand how this logic is structured in the techniques used as an active methodology in the teaching-learning process and what its possible benefits, advantages and disadvantages (BUSARELLO et al., 2014).

The elements of games are objectives, clear rules, immediate *feedback*, rewards, intrinsic motivation, inclusion of the error in the process, narrative, levels, competition, cooperation, voluntariness, among others. Applying gamification is like using multiple tools (game elements) that are inside a box, and that can be combined in various ways. However, for its correct use, one must know what are the functions of each one and how they will interact within the proposed system. It is important to note that to gamify an activity it is not necessary to use all the elements of games, but only some, that is, you can use from a reduced number to a greater number of elements (KAPP, 2012).

Gamification can promote learning because many of its elements are based on techniques that instructional designers and teachers have been using for a long time. Features such as distributing scores for activities, presenting *feedback*, and encouraging collaboration on projects are the goals of many pedagogical plans. The difference is that gamification provides a more explicit layer of interest and a method to align these elements in order to achieve similarity with games, which results in a language to which individuals inserted in digital culture are more accustomed and, as a result, can achieve these goals in a seemingly more efficient and pleasant way (FARDO, 2013).

Thus, for the teacher to be able to succeed in his activities, it is interesting that he knows some theoretical aspects associated with gamification: the theory of self-determination and the theory of flow. The Self *Determination Theory* (SDT) proposes to explain the components of motivations (extrinsic and intrinsic) and the factors related to their promotion, which involves epistemological issues related to health and psychological well-being (DECI; RYAN, 1985). Autonomy, competence and belonging should be incorporated into the gamification process, which are three basic needs innate to intrinsic motivation, which is characterized by the subject's internal interest in himself, in satisfying himself when performing an activity and voluntarily engaging to generate necessary autonomy in the student (SILVA et al., 2019). Intrinsically motivating students in the classroom is a complex and challenging task for the teacher, which demands time and theoretical knowledge. The Flow Theory, created by the Hungarian psychologist Mihaly Csikszentmihalyi in 1990, set out to explain what are the reasons that lead people to be completely involved and concentrated in certain activities that do not provide any kind of material or financial return. In short, this theory seeks to describe the mental state of automated operation, in which the subject is completely immersed in a sense of energizing focus (deep concentration, involvement and pleasure) when engaging in a specific activity, in which there is a balance between the level of difficulty of the challenge and the compatible ability of the subject, in a way that allows its successful realization.

Computers, mobile phones, *tablets,* notebooks*, netbooks* and the   use of the Internet, have made accessing the web easier and easier. They also allowed infinite possibilities to their users, one of them being mobile learning, which corresponds to learning in any place and space, going beyond the walls of the classroom, making access to teachers and content faster (BOTTENTUIT JUNIOR, 2017).

Education through online tools, for example, encompasses possibilities of using resources available in the network both in person and at a distance, and there may still be a combination of both. An example is the use of the *Kahoot* application that can be employed in various ways, depending on the educational objectives, such as the use of the tool to review students' knowledge about the contents worked in the classroom, in an interactive and engaging way (WANG et. al., 2020).

Kahoot is a free, game-based learning platform that aims to unlock each student's deepest potential through fun and inclusive learning. Among the possibilities available, this platform enables the creation of questionnaires (*quiz*) that can be answered by users who are connected to the internet through mobile phones or computers, simply by registering on the virtual teaching platform. The teacher elaborates the questions corresponding to the content and allows them to appear on the screen with their respective options, the students have a time to choose the alternative that they find correct for that question, being who answers in less time gets the highest score in the form of ranking, which is accumulated at the end of the quiz. At each round the correct answer is given by the students and teacher, thus making the moment more propitious for debates and discussions about the theme worked, resolving the doubts that still exist (CADET, 2023).

The application of Gamification in higher education invites teachers to look closely and analytically at pedagogical games, investigating the potential of the method to help learning in a meaningful way, thus acting more as "a manager and advisor of collective and individual paths, predictable and unpredictable, in a more open, creative and entrepreneurial construction" (MORÁN, 2015).

Given this panorama there are enough referrals to glimpse the playful capacity, aggregation, induction, provocation, systematic organization, dissemination and construction of knowledge, starting from the conceptions of common sense until reaching the epistemic layers that are of interest to the teacher-facilitator to achieve a certain end. The experience proposes to observe hours as teachers, and it is explicit that the playfulness, language and atmosphere that are intrinsic to the games can lead the teaching-learning proposals to their purpose, logically protected proportions and limitations (FADEL et al*.,* 2014). Given the lack of student motivation in recent years in Brazil, several empirical studies have emerged on the application of active methodologies in teaching, among them are: team-based learning; problem-based learning and clinical rounds.

Clinical Rounds, for example, aim to provide meaningful discussions about cases being conducted by students in clinical settings. This methodology helps to improve professional reasoning and allows the student to have guidance and supervision by the teacher. For its realization, there is an independent study in small groups based on the structure of the SNAPPS methodology, being an acronym of six specific steps: Summarize, Narrow, Analyze, Probe, Plan, Select (NEUMANN et al., 2019).

This model represents a paradigm shift in education that involves the student and creates a collaborative learning conversation in the context of patient care, having six stages: (1) brief summarization of history and clinical findings; (2) delimitation of the differentials of two or three relevant possibilities; (3) analysis of these differentials, comparing and contrasting the possibilities; (4) asking questions about uncertainties, difficulties, or alternative approaches; (5) planning the management of patient demands; and (6) selection of a similar case to guide independent study and learning (WOLPAW; WOLPAW; PAPP, 2003).

The main learning objectives contemplated in the clinical rounds is to diagnose, propose, develop, evaluate, synthesize, judge and argue about a certain problem related to a certain case, generating a collaborative learning in the context of patient care, and in the remote environment during this pandemic period it is noticeable a greater participation of students in this methodology when compared to the face-to-face, because they feel more comfortable and less timid to express their opinion virtually, thus generating more ideas and discussions about the clinical case studied (MACEDO et. al., 2018).

Another important point to be highlighted is in relation to virtual laboratory applications, which are increasingly being used today, replacing conventional practical work. This shift has already begun even before this pandemic, due to the progress of digital technology. These practical activities, conventional or virtual, are integral parts of the curriculum and scientific instruction of the health professional, because they are real demonstrations and implementation of what students learn in theory about certain subjects, whose scripted practices associated with the pedagogical plan of the educational institution and follow with a high degree of fidelity the experiments carried out in the physical equipment of the platform that has the virtual laboratory. At predetermined points of the contents addressed by each discipline, the virtual learning environment indicates that the student needs an experience through the virtual laboratory, because after the completion of the virtualized practices, the student acquires competencies and is enabled for experimentation (ALNEYADI, 2019).

Virtual laboratories have been showing positive effects on student knowledge, skills, attitudes and outcomes, increasing student involvement, motivation and performance, as well as on the innovation of active teaching methodology. It is considered that this proposal aligns with the need to rethink the process of more interactive teaching-learning for the student, to promote autonomy and to respect the time of each one in the consolidation and acquisition of competencies for work practice. At predetermined points of the contents addressed by each discipline, the virtual learning environment indicates that the student needs a practice through the virtual laboratory, it is worth mentioning that this was not used regularly before the pandemic, only on a narrow scale. It is recommended to maximize the use and effectiveness of virtual laboratories in order to provide contact with the technique

and theoretical basis, making it possible to redo, review, err, elaborate and mobilize the brain for the learning of current practices and also of scientific research (CARDOSO, *et. al,* 2021)

This investigation is known as a multifaceted activity that comprises making observations, asking questions, testing sources of information to see what is already known, planning investigations, and reviewing what is already known in light of experimental evidence, using tools to collect, analyze, interpret, and report the data, as well as provide explanations and predictions and display results. What makes research beneficial is that the laboratory learning environment reinforces the change in a purposeful and more student-directed investigation. In addition, science lab activities as learning experiences allow students to interact with materials and models to observe and understand the natural world (MA; NICKERSON, 2006).

In this process, the spirit of science posed challenges for teachers and students, since learning by investigation requires new methods and strategies drawn from different perspectives. Therefore, the main objective of these active methodologies addressed in this chapter is to make students learn autonomously and integratively, starting from real problems and situations, with students at the center of the learning process, actively participating and being responsible for the construction of knowledge. For this, it is necessary to have an integration of time, space and technology, and the current scenario of the pandemic exposes the student to access to a multitude of information, applications and didactic objects remotely. In this context, it is up to the teacher to *design* new paths, as well as the role of individual and group activities in an innovative way.

REFERENCES

ALNEYADI, S. S. Virtual Lab Implementation in Science Literacy: Emirati Science Teachers' Perspectives. **Eurasia Journal of Mathematics, Science and Technology Education**. v. 15, n. 12, 2019.

ALVES, F. **Gamification:** como criar experiências de aprendizagem engajadoras. Um guia completo: do conceito à prática. São Paulo: DVS Editora, 2014.

ASSOCIATION FOR EDUCATIONAL COMMUNICATIONS AND TECHNOLOGY. Definition. In: JANUSZEWSKI, A.; MOLENDA, M. (org.). **Educational Technology:** A definition with commentary. New York: Lawrence Erlbaum Associates, 2008.

BOTTENTUIT JUNIOR, J. B. **O aplicativo *Kahoot* na educação:** verificando os conhecimentos dos alunos em tempo real. Challenges 2017: Aprender nas Nuvens, Learning in the Clouds. Disponível em: https://ufma.academia.edu/Jo%C3%A3oBatistaBottentuitJunior. Acesso em: 12 de julho de 2020.

BUSARELLO, R. I.; ULBRICHT, V. R.; FADEL, L. M. A gamificação e a sistemática de jogo: conceitos sobre a gamificação como recurso motivacional. In: FADEL, L. M.; ULBRICHT, V. R.; BATISTA, C. R.; VANZIN, T (org.). **Gamificação na educação**. São Paulo: Pimenta Cultural, 2014. 300p.

Cadet, M. J. Application of game-based online learning platform: Kahoot a formative evaluation tool to assess learning, Teaching and Learning in Nursing, Vol. 18, Issue 3, p. 419-422, 2023.

CARDOSO, K.; ZARO, M. A.; MAGALHÃES, A. M. M.; TAROUCO, L. M. R.. Immersive learning laboratory in health and nursing: learning biosafety in a virtual world. Revista Brasileira De Enfermagem, p. 74, e20200385, 2021.

CSIKSZENTMIHALYI, M. **Flow:** The Psychology of Optimal Experience. New York: HarperCollins, 1990.

DECI, E. L.; RYAN, R. M. **Intrinsic Motivation and Self Determination in Human Behavior**. New York: Plenum,1985.

FADEL, L. M.; ULBRICHT, V. R.; BATISTA, C. R.; VANZIN, T. **Gamificação na educação.** São Paulo: Pimenta Cultural, 2014.

FARDO, M. L. **A gamificação como método: estudo de elementos dos games aplicados em Processos de ensino e aprendizagem.** Dissertação (Mestrado em Educação) Universidade de Caxias do Sul, Rio Grande do Sul, 2013.

HLYNKA, D.; JACOBSEN, M. What is educational technology, anyway? A commentary on the new AECT definition of the field. **Canadian Journal of Learning and Technology**. v. 35, n. 2, 2009.

KAPP, K. M. **The gamification of learning and instruction:** game-based methods and strategies for training and education. San Francisco: Pfeiffer, 2012.

MA, J.; NICKERSON, J. V. Hands-on, simulated, and remote laboratories: A comparative literature review. **ACM Computing Surveys (CSUR)**. v. 38, n. 3, p. 7, 2006.

MACEDO, K.D.S.; ACOSTA, B.S.; SILVA, E.B.; SOUZA, N.S.; BECK, C.L.C.; SILVA, K.K.D. Metodologias ativas no ensino em saúde. Escola Anna Nery, 2018.

MORÁN, J. Mudando a educação com metodologias ativas. Coleção Mídias Contemporâneas. In: **Convergências Midiáticas, Educação e Cidadania:** aproximações jovens. SOUZA, C. A.; MORALES, O. E. T. (org.). v. 2. PG: Foca Foto-PROEX/UEPG, 2015. Disponível em: https://bit.ly/2df2NUX. Acesso em: 15 de julho de 2020.

NEUMANN, C. R.; GERBASE, M. W.; BLANK, D.; CAPP, E. **Avaliação de competências no internato:** atividades profissionais confiabilizadoras essenciais para a prática médica. Porto Alegre: UFCSPA / UFRGS, 2019.

SILVA, J. B.; SALES, G. L.; CASTRO, J. B. Gamificação como estratégia de aprendizagem ativa no ensino de Física. **Rev. Bras. Ensino Fís.** São Paulo, v. 41, n. 4, 2019.

WANG, A.I. et al. The effect of using Kahoot for learning – A literature review Computers & Education, Vol. 149, 2020.

WOLPAW, T. M.; WOLPAW, D. R.; PAPP, K. K. SNAPPS: a learner-centered model for outpatient education. **Acad Med.** v. 78, n. 9, p. 893-898, 2003.

ZABALA, A. Os enfoques didáticos. In: COLL, C.; MARTÍN, E.; MAURI, T.; MIRAS, M.; ONRUBIA, J.; SOLÉ, I.; ZABALA, A (org.). **O construtivismo em sala de aula.** São Paulo: Ática, 2003.