Profile and the perceptions of distance undergraduate learning students towards using H5P interactive content during the teaching and learning process of the sustainability education

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Final report presented to the University Fernando Pessoa as part of the requirements for obtaining the post-doctoral degree in E-learning, under the supervisor of Prof. Luis Borges Gouveia, PhD.

Previous Note: This final report presented integrates in the main body articles published to international peer-reviewed scientific journals, beside other technical production. These results have been also partially presented in a congress in the specialty area. The candidate also states that he conceived the ideas, compiled the data, analysed, and discussed the results, and led the writing of the different chapters.

(i) Papers

Roveri, V. Caivano, S. Gouveia, B. L. Perceptions of distance undergraduate learning students towards use H5P interactive content during the teaching and learning process of the environmental education. Revista Paidei@, UNIMES Virtual, Volume 15, Número 27, Abr. 2023. p. 05-26. DOI:10.5281/zenodo.8087092. A. **(Qualis – CAPES: A4).**
https://periodicos.unimesvirtual.com.br/index.php/paideia/article/view/1515

Roveri, V. Caivano, S. Gouveia, B. L. Statistical Dataset on the profile and the perceptions of undergraduate learning students towards use H5P interactive content during the teaching and learning process on the distance education. Revista Contribuciones a Las Ciencias Sociales. VOL. 16 NO. 7. DOI: 10.55905/revconv.16n.7-042 **(Qualis – CAPES: A4).**
https://ojs.revistacontribuciones.com/ojs/index.php/clcs/article/view/1120

(ii) Other technical production

Roveri, Vinicius (2023), "A 16 videos dataset demonstrating different simulations of the H5P interactive content during the teaching and learning process of the environmental education", Mendeley Data, V6, DOI: 10.17632/597333hvjv.6
https://data.mendeley.com/datasets/597333hvjv/6

(iii) Congress

Roveri, V. Caivano, S. Gouveia, B. L. Percepções de estudantes de graduação a distância sobre o uso do conteúdo interativo do H5P durante o processo de ensino e aprendizagem. In: CONBRAED2023 - III Congresso Brasileiro de Educação a Distância On-line, 2023. Revista Multidisciplinar de Educação e Meio Ambiente, 2023. v. 4. p. 1-1. DOI: 10.51189/iii-conbraed/19953. Summary (Poster).
https://ime.events/conbraed2023/painel/trabalhos

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“TODOS OS DIREITOS RESERVADOS”

ABSTRACT

Although studies have shown that E-learning is an area that has seen considerable growth among worldwide higher education institutions (HEIs), online students' dissatisfaction seems to increase at the same rate. For instance, studies have shown the lack of interactivity features of virtual learning environments (VLE) (such as Moodle), is still one of the main dissatisfactions of this students. One tool that allows to increase interactivity resources of Moodle is plugin H5P (HTML 5 Package). Considered a versatile and uncomplicated open-source tool, H5P allows educators to create more than 40 interactive Moodle-based learning objects. The aim of this study was to verify the perception of 395 DL undergraduate students (from 19 different undergraduate courses) at a private Brazilian HEI about the use of H5P Moodle interactive content during the teaching and learning process of the environmental education (EE). The hypothesis, in line with previous studies, is that the most students would report positive and/or motivating experiences after studying through interactive resources. Based on a quantitative, descriptive, and cross-sectional study, these volunteer students carried out the following contributions to this research: (i) They compared the virtual learning environment VLE Moodle traditional didactic resources (i.e., booklet plus non-interactive video lessons) versus several H5P Moodle interactive resources [namely, (a) Collage; (b) Timeline; (c) Drag and Drop; (d) Accordion; (e) True/False questions; (f) Image slider; (g) Find the Hotspot; (h) Fill in the Blanks; (i) Memory Game; (j) Image Juxtaposition; and (k) Virtual Tour (360), among others]. Specifically, the subject studied was “concepts of Ecology”; (ii) Soon after, they answered an instrument comprised two analysis dimensions (D) (i.e., D1: Feasibility and D2: Motivation) consisting of 14 questions (Q) of the Likert-type. Both research steps were accessed via the Moodle LMS. The student’s participation was completely voluntary, anonymous and did not include any information that could have revealed their identities, to protect their privacy. There were no exclusion criteria. Besides, each student was allowed to complete the questionnaire once; (iii) Ultimately, multiple statistical comparisons were performed. For instance, to test whether there is a significant correlation between dimensions D1 and D2, the Canonical correlation analysis was use. In addition, to test whether there is a significant correlation between the 14 questions (i.e., Q1-Q14), Spearman Rank Order correlation was use. Ultimately, in order to test if there are differences in opinions between students, regarding the variables: gender; academic majors; grade level; and Brazilian regions they inhabit, three statistical tests were performed, namely: (a) the independent samples t test; (b) the Fisher's statistic; and (c) the Tukey's posterior test. 122 among those 395 students invited, agreed to participate (i.e., 30.9%). Most of the participating students were from the Pedagogy course (81 students), followed by the Public Management course (18 students). The study on the reliability of the instrument resulted in a coefficient equal to 0.80. Therefore, it is possible to state that on another occasion, these students would respond to the instrument in the same way. The number of validated assertions was 11/14 (a loss of the 21.40% of the assertions). However, the loss of up to 40% of the total statements is considered adequate when using the Likert scale. Considering only these 11 validated assertions, the overall main of the instrument was 3.35 points (Standard Deviation = 0.36), which demonstrates a positive student perception of the evaluated object. Ultimately, the tested hypothesis was confirmed, and thus, in line with previous studies, the most students reported positive and motivating experiences after having studied EE through H5P interactive resources. The availability of this dataset as an open access dataset will provide educational policymakers, and mainly academics with a better

understanding of the perceptions of distance undergraduate learning students towards use H5P interactive content, allowing them to make more informed decisions during the teaching and learning process on the distance education mode.

Keywords: Active Learning; Computer-Assisted Learning; Moodle; Playful learning; Plugin H5P; Sustainability Education; Technology Enhanced Learning; Virtual learning Environments.

DEDICATÓRIA (Dedicatory, Portuguese only)

Dedico especialmente este trabalho, à minha querida e inesquecível mãe **Alice** *"in memorian"*, e ao meu padrasto **Hans** *"in memorian"*. Tenho certeza de que continuam iluminando os caminhos dos seus filhos, além de comemorar todas as nossas vitórias.

Dedico, também, à minha esposa **Cyntia**, aos meus irmãos, **Rodrigo** e **Samanta**, e ao meu sobrinho **Kron**. Vocês são inspiração para todos os meus dias!

Amo vocês!!

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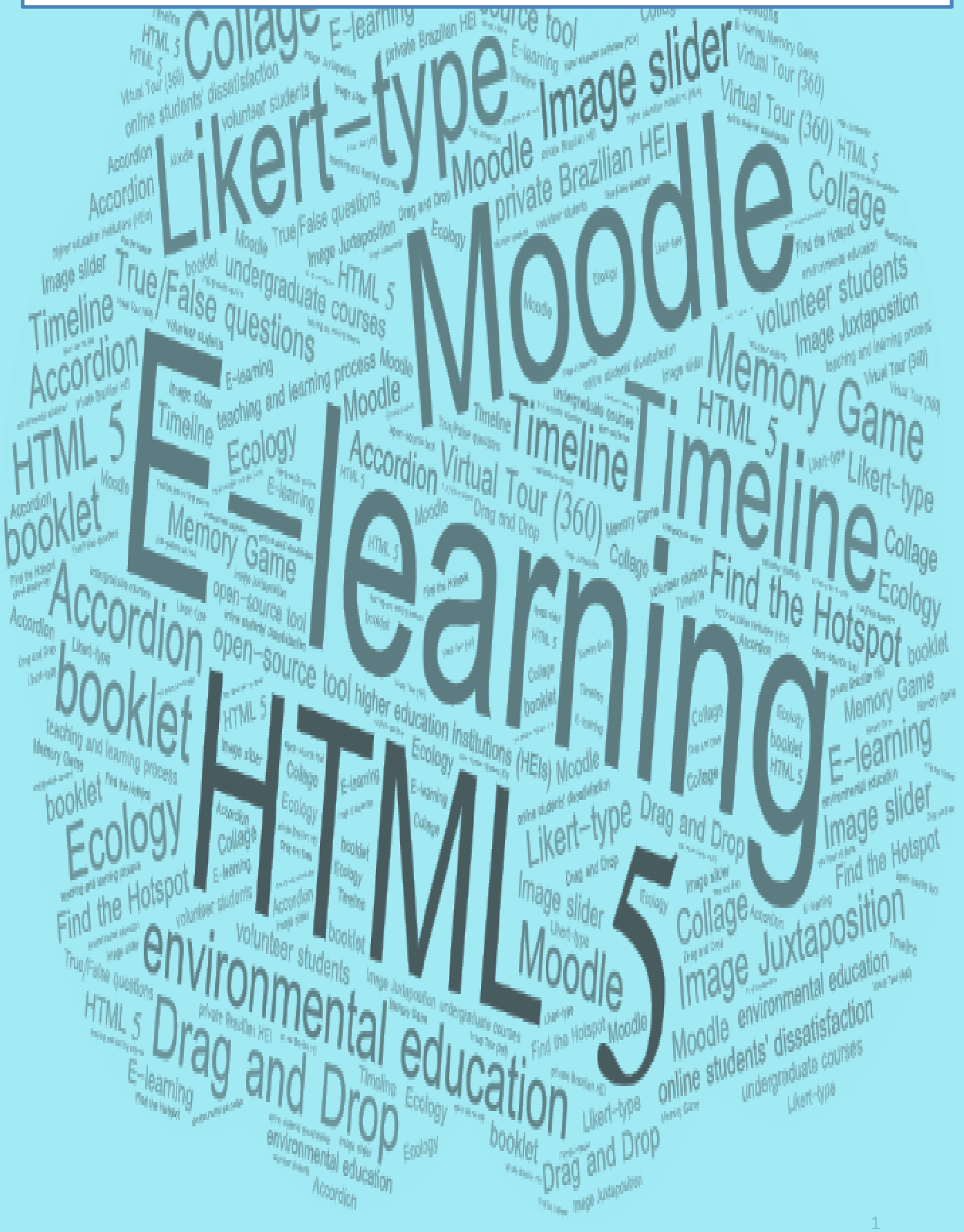
CHAPTER I - General Introduction



1.1 General Introduction

Distance Education (DE), also called e-learning, is a teaching modality that has been gaining more space in higher education institutions (HEIs) and in the educational market in recent years (ZAWACKI-RICHTER & ANDERSON, 2015; MARTINS & RIBEIRO, 2019; PEREIRA & RODRIGUES, 2021). According to National Institute of Educational Studies and Research Anísio Teixeira (INEP) in Brazil, 3.7 million students who enter public and private HEIs in 2020, more than 2 million (53.4%) opted for distance learning courses (INEP, 2021).

DE can be understood as a teaching-learning process whose main characteristic is the presence of a Virtual Learning Environment (VLE), in order to allow interaction between professors and students. (ZAWACKI-RICHTER & ANDERSON, 2015; MARTINS & RIBEIRO, 2019; PEREIRA & RODRIGUES, 2021). Different VLE models are used for the development of DE, such as Blackboard, Eadbox, and Google G Suite for Education (ROSSETTI LÓPEZ et al., 2019; SINGLETON & CHARLTON, 2019; ADDHINY, 2022). However, the most used VLE worldwide is Moodle (Modular Object-Oriented Dynamic Learning Environment), a free software with more than 25,000 registered installations in 155 countries (including Brazil), which serves approximately 4 million students in DE (ROSSETTI LÓPEZ et al., 2019; SINGLETON & CHARLTON, 2019; ADDHINY, 2022).

Interaction student/professor in VLE – Moodle occurs synchronously (e.g., through web conferences and chats), or asynchronously (through messages or forums) (ROSSETTI LÓPEZ et al., 2019; SINGLETON & CHARLTON, 2019; ADDHINY, 2022). However, for some researchers in the field of DE, the Moodle still lacks effective interactivity. Consequently, increasing the interactivity of Moodle is one of the main challenges today (PRADO & ROSA, 2008; CAPELETTI, 2014; De Oliveira & Nascimento, 2020). In this context, in recent years, there has been the development of new Information and Communication Technologies (ICT) which began to provide effective interactivity in the DE teaching and learning process (SINGH & SCHOLZ, 2017; CHILUKURI et al., 2020; REYNA & TODD, 2020).

Among these ICTs, there is the H5P plugin (HTML 5 Package), an open-source application package that allows the use of interactive resources in VLE – Moodle (SINGH & SCHOLZ, 2017; CHILUKURI et al., 2020; REYNA & TODD, 2020). H5P includes more than 40 editable content applications such as interactive videos, audio recordings,

presentations, virtual tours, branching scenarios, games, quizzes, flashcards, among others (see more details in H5P.org) (SCHWEIKER & LEVONIS, 2020; KILLAM et al., 2021; YOUHASAN et al., 2021). As the main advantages of using H5P can be mentioned:

(i) H5P is a versatile and powerful tool that can help keep students motivated and engaged (ROSSETTI LÓPEZ et al., 2019; KILLAM et al., 2021; ADDHINY, 2022).

(ii) H5P is compatible with any mobile device and, therefore, can be accessed by students through cell phones or tablets (ROSSETTI LÓPEZ et al., 2019; KILLAM et al., 2021; ADDHINY, 2022).

(iii) Most of the H5P content can be used by disabled people (e.g., visual and auditory) (ROSSETTI LÓPEZ et al., 2019; KILLAM et al., 2021; ADDHINY, 2022).

In this way, due to the wide possibility of applying the H5P in the field of education, there are reports of experiences in different areas of knowledge, namely: in the training of Librarians (SINGH & SCHOLZ, 2017), in the teaching of engineering (CHILUKURI et al., 2020), in Chemistry (SCHWEIKER & LEVONIS, 2020), in Medicine (KILLAM et al., 2021), in Administration (ROSSETTI LÓPEZ et al., 2021), in Nursing (YOUHASAN et al., 2021), and in the degree in English (ADDHINY, 2022).

Despite these advantages and different applications of H5P, there is still an information gap to be solved: What is the perception of DE students about the use of H5P as an interactivity resource?

One of the protocols available to measure students' perceptions is the attitudinal perception scale proposed by Rensis Likert (1903-1981) (LIKERT, 1932). Even today, the Likert scale is still one of the most effective ways of measuring perception, behavior, and attitudes (BALASUBRAMANIAN, 2012; CAMPARO (2013).

1.2 Main Objective

Given the above, the purpose of this post-Doc report will be to verify the perception of DE undergraduate students about the use of interactive H5P content during the teaching and learning process.

1.2.1 Specific objectives

The specific objectives of this report were:

- To verify the perception of 395 DE undergraduate students from a Brazilian private university about the use of interactive H5P Moodle content during the teaching and learning process of environmental education (EE).

- To present a statistic dataset on profile and the perception of these DE undergraduate students.

1.3 Structure of the report

In order to meet these specific objectives and to allow a better understanding of the data obtained, the report was organized in three chapters. Chapter 1 contextualizes the work and justifies the choice of the subject, respectively. The main body of the report (i.e., Chapter 2, and 3) are results already published in peer-reviewed scientific journals, which will be described in more detail.

- Chapter 2: "Perceptions of distance undergraduate learning students towards use interactive H5P content during the teaching and learning process of the environmental education". At this stage of the research, an evaluation of the perception of 395 distance learning undergraduate students from a Brazilian private university about the use of interactive H5P Moodle content during the teaching and learning process of environmental education (EE). The hypothesis, in line with previous studies, is that most students would report positive experiences after studying through interactive resources. This chapter was published in the Paidei@ - Revista Científica de Educação a Distância (2023).

- Chapter 3: "Dataset on the profile and the perceptions of undergraduate learning students towards use of interactive H5P content during the teaching and learning process on the distance education". At this stage of the research, multiple statistical comparisons were performed. For instance, testing for differences of opinions between students, regarding the variables: (a) gender; (b) academic majors; (c) grade level; and Brazilian regions they inhabit, three statistical tests were performed, namely: (a) the independent samples t test; (b) the Fisher's statistic; and (c) the Tukey's posterior test. This chapter was published in the Revista Contribuciones a Las Ciencias Sociales (2023).

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CHAPTER II - Perceptions of distance undergraduate learning students towards use H5P interactive content during the teaching and learning process of the environmental education

Perceptions of distance undergraduate learning students towards use H5P interactive content during the teaching and learning process of the environmental education

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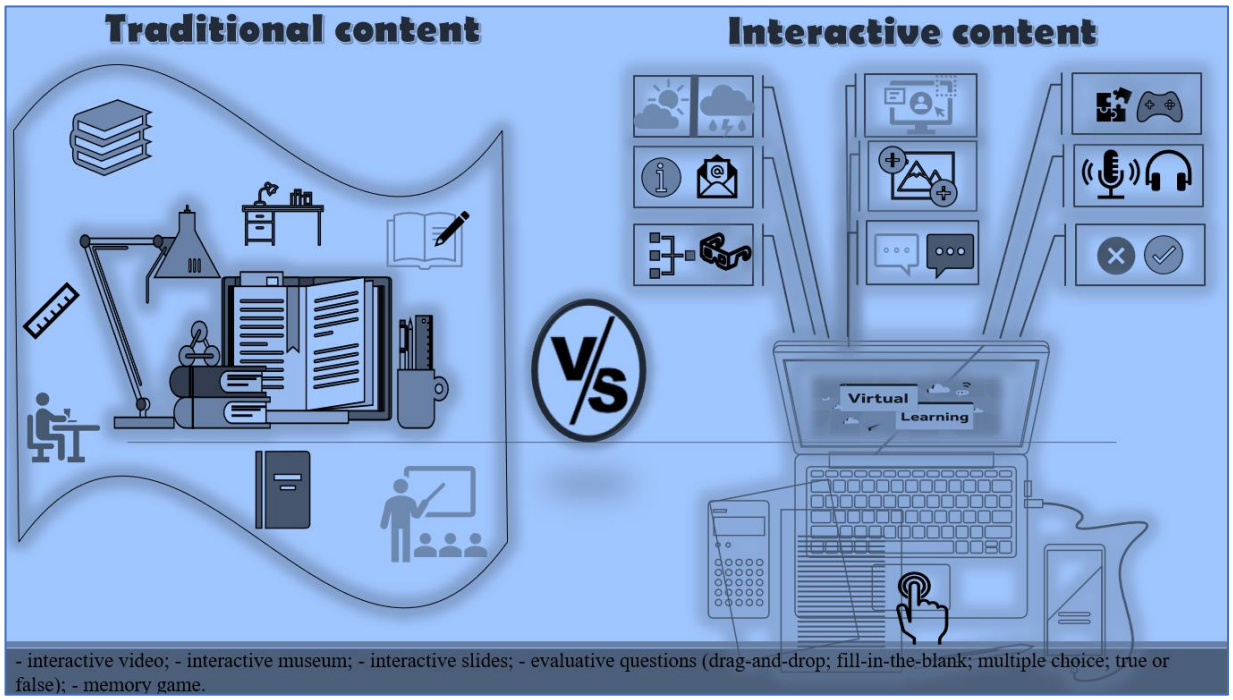
Graphical Abstract



Abstract

The aim of this study was to verify the perception of 395 distance learning undergraduate students at a Brazilian private university about the use of H5P Moodle interactive content during the teaching and learning process of environmental education (EE). The hypothesis, in line with previous studies, is that most students would report positive experiences after studying through interactive resources. Based on a quantitative, descriptive, and cross-sectional study, these volunteer students carried out the following contributions to this research: (i) They compared the VLE Moodle traditional didactic resources versus H5P Moodle interactive resources. Specifically, the subject studied was "concepts of Ecology"; (ii) They answered an instrument comprised two analysis dimensions (i.e., Feasibility and Motivation) consisting of 14 assertions of the Likert-type. 122 among those 395 students invited, agreed to participate. The study on the reliability of the instrument resulted in a coefficient equal to 0.80. Therefore, it is possible to state that on another occasion, these students would respond to the instrument in the same way. The number of validated assertions was 11/14 (a loss of the 21.40% of the assertions). However, the loss of up to 40% of the total statements is considered adequate

when using the Likert scale. Considering only these 11 validated assertions, the overall main of the instrument was 3.35 points (Standard Deviation = 0.36), which demonstrates a positive student perception of the evaluated object. Ultimately, the tested hypothesis was confirmed, and thus, the most students reported positive experiences after having studied EE through H5P interactive resources.

Keywords: Moodle. Plugin H5P. Technology enhanced learning. Active Learning. Playful learning.

2.1 Introduction

E-learning (based on information and communication technologies - ICT) is a teaching and learning process that occurs in virtual learning environments (VLE), and where multidirectional communication is possible, i.e., teacher-student and student–student (PEREIRA *et al.*, 2008; AZEITEIRO *et al.*, 2015; AMALI *et al.*, 2019). Moreover, the use of interactive multimedia technology, which combines computer technology, audio, and video, is the main characteristic of this teaching and learning process (AMALI *et al.*, 2019). Currently, more than 550 different kinds of VLEs are available worldwide for educational purposes (SERGIS *et al.*, 2017; OGUGUO *et al.*, 2021; GAMAGE *et al.*, 2022). Among the VLEs that were most widely used during 2015–2020, the Moodle Learning Management System (LMS) is the most popular and preferred open-source LMS (SERGIS *et al.*, 2017; OGUGUO *et al.*, 2021; GAMAGE *et al.*, 2022). Consequently, the number of Moodle users increased from 78 million in 2015 to over 294 million in 2021 (an increase of over 250%) (GAMAGE *et al.*, 2022).

E-learning is an area that has seen considerable growth among worldwide higher education institutions (HEIs), particularly since 2020 with the onset of the COVID-19 pandemic (PAGAN *et al.*, 2021). For instance, in Brazil, the E-learning has become prevalent in HEIs recently. According to data from the National Institute of Educational Studies and Research Anísio Teixeira (INEP), from 3.7 million students entering public and private HEIs in 2020, more than 2 million (53.4%) opted for distance learning pedagogical model (DL) (INEP, 2021). As a result, this movement has increased educational opportunities for students (mainly in developing countries such as Brazil) who were previously unable to access university-level tertiary qualifications (LLERENA-IZQUIERDO AND ZAMORA-GALINDO, 2021; VONTI AND HIDAYATI, 2023).

Although studies have shown that worldwide E-learning in HEIs is growing, online students' dissatisfaction seems to increase at the same rate. A common complaint among these students is that the online learning experience is isolating and demotivating (STONE AND SPRINGER, 2019; MANACEK *et al.*, 2020). Furthermore, studies have shown the lack of interactivity features of VLEs (such as Moodle), is still one of the main dissatisfactions of this students, which has contributed to an increase in school attrition rates (CAPELETTI, 2014; STONE AND SPRINGER, 2019; MANACEK *et al.*, 2020; DE OLIVEIRA AND NASCIMENTO, 2020). In this context, the ICTs provide an opportunity for HEIs to create course content that is interactive, personalised, and leads to improvements in learning outcomes (WEKERLE *et al.*, 2020; LAI AND BOWER, 2020; JACOB AND CENTOFANTI, 2023). For instance, one tool that allows to increase interactivity resources of Moodle is plugin H5P (HTML 5 Package) (KILLAM *et al.*, 2021; MUNRO, 2021; JACOB AND CENTOFANTI, 2023). Considered a versatile and uncomplicated open-source tool, H5P allows educators and/or instructional designers to create a variety of interactive Moodle-based learning objects (KILLAM *et al.*, 2021; MUNRO, 2021; JACOB AND CENTOFANTI, 2023). Specifically, H5P includes more than 40 editable content applications such as interactive videos, audio recordings, presentations, virtual tours, branching scenarios, games, quizzes, flashcards, among others (see more details in H5P.org) (KILLAM *et al.*, 2021; MUNRO, 2021; JACOB AND CENTOFANTI, 2023).

In this way, due to the wide possibility of applying the H5P in the field of education, there are reports of experiences in different areas of knowledge, namely: in the training of Librarians (SINGH AND SCHOLTZ, 2019), in the teaching of Engineering (CHILUKURI, 2020), in the degree of Chemistry (SCHWEIKER AND LEVONIS, 2020), in Medicine (KILLAM *et al.*, 2021), in Administration (ROSSETTI LÓPEZ *et al.*, 2021), in Nursing (YOUHASAN *et al.*, 2021), and in the degree of English (ADDHINY, 2022). However, to the best of our knowledge, there are no reports of experiences in worldwide HEIs, about the use of H5P during teaching and online-learning process of the environmental education (EE). The EE is an essential tool to implement the 17 United Nations Sustainable Development Goals (SDGs) in the university context (UN, 2015; ESTEBAN IBÁÑEZ *et al.*, 2020; BABALOLA *et al.*, 2021). Specifically, Target 4.7 of SDG4 aims to ensure that worldwide students "acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles" by the year 2030 (UN, 2015). For

instance, in Brazilian HEIs, the EE is a cross-cutting theme, and must be offered as an elective to all presential and DL undergraduate courses (BRASIL, 1996; 1999). Corroborating the Target 4.7 of SDG4, the Brazilian Curricular Parameters (BCPs), establish that an EE is a fundamental tool for teaching people to have social environmental responsibility (BRASIL, 1996; 1999). Therefore, these graduates will be potential change actors with the ability to contribute to a more sustainable society (UN, 2015; ESTEBAN IBÁÑEZ *et al.,* 2020; BABALOLA *et al.,* 2021).

Taking into consideration the previous research gaps, the aim of this study is to verify the perception of 395 DL undergraduate students (from 19 different undergraduate courses) at a private Brazilian HEI about the use of H5P Moodle interactive content during the teaching and learning process of the EE. The hypothesis, in line with previous studies (e.g., CARR AND BARRY, 2020; CARR., 2021; LÓPEZ et al., 2021; SINNAYAH *et al.,* 2021; PLOETZNER, 2022; JACOB AND CENTOFANTI, 2023; VONTI AND HIDAYATI, 2023), is that the most students would report positive and/or motivating experiences after studying EE through H5P interactive resources.

2.2 Methods

2.2.1 Ethical aspects

This study was approved by the Ethics Research Committee of the Metropolitan University of Santos (UNIMES) - opinion n. 5.788.781, and by the system CEP/CONEP - CAAE n. 63995822.7.0000.5509. At the commencement of the research, all students were informed about the study casuistry. The students that agreed to voluntarily participate, were informed that they would have access to the H5P Moodle interactive resources and undertake a questionnaire as part of the research. Moreover, the students were informed that they would be free to opt out at any time if they did not want their questionnaire results to be included in analyses. They were also informed that opting out would not detrimentally impact them, their research results, or their relationship with teaching staff in any way.

2.2.2 Study characteristics

This is a quantitative, descriptive cross-sectional survey conducted among 395 DL undergraduate students at UNIMES, and regularly enrolled in the EE discipline. In UNIMES, the EE is a cross-cutting theme, and offered as an elective discipline to all DL undergraduate courses (BRASIL, 1996; 1999). These students come from 19 undergraduate courses, namely: Accounting Sciences, Administration, Architecture, Biological Sciences, Chemistry, Commercial Management, Environmental Management, Gastronomy, Geography, Information Technology, Letters, Logistics, Management Processes, Mathematics, Physical Education, Physics, Public Management, Pedagogy, and Social Work. In summary, these volunteer students carried out the following contributions to this research: (i) Firstly, they compared the VLE Moodle traditional didactic resources versus H5P Moodle interactive resources; (ii) Ultimately, they answered the questionnaire about the "perceptions of distance undergraduate learning students towards use H5P interactive content during the teaching and learning process of the environmental education". Both research steps were accessed via the Moodle LMS, and they were conducted during December 02, 2022, to February 02, 2023. There were no exclusion criteria. Besides, each student was allowed to complete the questionnaire once.

2.2.3 Comparison between VLE Moodle traditional didactic resources and H5P Moodle interactive resources

It is important to highlight that these 395 students studied EE during the 2nd semester of 2022 (i.e., from August to November 2022). However, this study was developed in VLE Moodle through the following traditional didactic resources, namely: (i) reading a handout; and (ii) video lessons (both prepared by the professor). Specifically, the subject studied was "concepts of Ecology". From this experience, these students were allocated in another VLE Moodle virtual classroom, which was prepared with H5P interactive resources. In this way (from December 2022 to February 2023), these students carried out interactive activities with the same theme addressed in the traditional didactic resources. After both experiences, it was possible to establish a comparison between both teaching methodologies (i.e., use of Moodle traditional didactic resources versus use of H5P Moodle interactive resources).

2.2.4 Analysis instrument

The analysis followed the methodology of Caivano and Domene (2020). The response to the instrument was conducted in two phases; the first phase, the instrument was pre-tested by a group of five professors form UNIMES, to analyse the statements' clarity and phraseology, objectivity, and assertiveness. In phase II, the instrument was answered by DL undergraduate volunteer students at UNIMES. The instrument comprised two analysis dimensions consisting of 14 assertions of the Likert-type (Table 1) (WAKITA *et al.*, 2012).

Table 1. Instrument applied to evaluate the "perceptions of distance undergraduate learning students towards use H5P interactive content during the teaching and learning process of the environmental education". The instrument comprised two analysis dimensions consisting of 14 assertions of the Likert-type. The analysis dimensions (D) were: (D1) Feasibility in the use of H5P Moodle interactive resources to promote the EE teaching-learning process in DL [assertions (A): A1,A2,A3,A4,A5,A6 and A7]; and (D2): Motivation of students to study with the support of the H5P plugin [assertions (A): A8, A9, A10, A11, A12,A13 and A14]. To ensure the legitimacy and consistency of the responses, similar assertions were used, in addition to interspersing positive (e.g., A1, A3, A4, A6, A8, A10, A11 and A14), and negative assertions (e.g., A2, A5, A7, A9, A12 and A13). Note: Numerical values that indicates the answer possibilities: ***a*=positive:** (4) Completely agree, (3) Agree in most cases, (2) Disagree in most cases, (1) Completely disagree; ***b*=negative:** (1) Completely disagree, (2) Disagree in most cases, (3) Agree in most cases, (4) Completely agree.

Dimensions (D)	Assertions (A)	Assertions description	Assertion types
D1	A1	The gamification (I) proposed by some activities transforms written content into more accessible materials and therefore facilitates learning. (I) Gamification: activity that refers to a game/simulation ***a***.	Positive
D1	A2	Some interactive contents (II) are highly complex and, therefore, make learning difficult. (II) Interactive content: examples are: (a) interactive video; (b) interactive museum; (c) interactive slides; (d) evaluative questions (drag-and-drop; fill-in-the-blank; multiple choice; true or false); (e) memory game, among other contents ***b***.	Negative
D1	A3	With the use of different interactive resources, merely expository contents (such as a handout) were transformed into something dynamic and interesting ***a***.	Positive
D1	A4	Compared to traditional study (that is, through a booklet and video lessons), studying through interactive resources makes it easier for students to absorb the content and their learning becomes efficient and accelerated ***a***.	Positive
D1	A5	After using different interactive resources, the virtual learning environment became visually polluted (excess images), making learning difficult ***b***.	Negative
D1	A6	The different knowledge tests (e.g., multiple choice or true and false questions), combined with different interactive features, facilitate learning ***a***.	Positive

D1	A7	Although the “memory game” works on concentration and the development of students' quick thinking, this ludic didactic resource (iii) is not suitable for higher education. (iii) Ludic: Way to develop creativity, knowledge, through games. The aim is to educate, teach, having fun ***b***.	Negative
D2	A8	Studying with the support of different interactive contents is more motivating than studying through traditional material (example, handout + video lesson) ***a***.	Positive
D2	A9	Carrying out studies, through interactive video, has become less intuitive and interesting ***b***.	Negative
D2	A10	The interactive contents are very attractive and, therefore, increase the students' attention ***a***.	Positive
D2	A11	The study, carried out with the support of different interactive resources [e.g., interactive video and virtual tour (360)], makes the student more active and engaged in the teaching and learning process ***a***.	Positive
D2	A12	The gamification proposed by some activities reduces attention to the studied content ***b***.	Negative
D2	A13	Studying with the support of different interactive resources makes studying more boring ***b***.	Negative
D2	A14	Studying with the support of an “interactive video” is more stimulating than watching a video lesson recorded by the teacher, because it helps to maintain attention on certain subjects considered monotonous ***a***.	Positive

The analysis dimensions (D) were: (D1) Feasibility in the use of H5P Moodle interactive resources to promote the EE teaching-learning process in DL; assertions (A): A1, A2, A3, A4, A5, A6 and A7; and (D2): Motivation of students to study with the support of the H5P plugin (A8, A9, A10, A11, A12, A13 and A14). To ensure the legitimacy and consistency of the responses, similar assertions were used, in addition to interspersing positive (e.g., A1, A3, A4, A6, A8, A10, A11 and A14), and negative assertions (e.g., A2, A5, A7, A9, A12 and A13) (Table 1) (MORAES *et al.,* 2012; WAKITA *et al.,* 2012). The questionnaire was organized with four possible answers, since a "neutral" position of the students was not intended, i.e.: (i) totally disagree; (ii) partially disagree; (iii) partially agree; and (iv) totally agree. The numerical order could be whether descending (4, 3, 2, 1) or ascending (1, 2, 3, 4) depending on the statement being favourable or unfavourable, thus enabling the calculation of mean values and standard deviation (MORAES *et al.,* 2012; WAKITA *et al.,* 2012). The mean value was used for verification of data behaviour and its dispersion based on the following definitions: (i) From 1.00 to 1.99 points: Poor perception of the evaluated object, which implied the necessity for changes or substitutions; (ii) From 2.00 to 2.99 points: The perception indicates the need for adjustments in the assessed object, but an overall positive perception of its implementation; (iii) From 3.00 to 4.00 points: Positive perception of the evaluated object; and (iv) Standard Deviation acceptable (SD): <1.5 points. Moreover, to measure the internal consistency of the instrument (i.e., reliability), Spearman-Brown coefficient was applied with acceptance criteria $r > 0.80$. Firstly, the "r" was calculated for the 14 assertions, aiming at their eliminating assertions with a linear correlation lower than 0.30. Afterwards, the "r" was calculated again, considering only the assertions validated in the first step. In this last step, only assertions with a linear correlation of less than 0.20, were eliminated. All statistical analysis was conducted from data processing using Statistical Package for Social Sciences – SPSS software version 18 for Windows.

2.3 Results and Discussion

Considering the lack of reports of experiences in worldwide HEIs about the use of H5P during teaching and online-learning process of the EE, this study verified, for the first time, the perception of 395 Brazilian students from 19 DL different undergraduate courses from UNIMES (a private Brazilian HEI) about the use of H5P Moodle interactive

content during the teaching and learning process of the cross-cutting theme EE. Among 395 students selected and invited, 30.9% agreed to participate (i.e.,122 students), being 87.7% women (107 students) and 12.3% men (15 students). Most of the participating students were from the Pedagogy course (81 students), followed by the Public Management course (18 students). Together, the other 17 courses added 23 participations.

The study on the reliability of the instrument resulted in a coefficient equal to 0.80. Therefore, it is possible to state that on another occasion, these students would respond to the instrument in the same way. The number of validated assertions was 11 (Tables 2a and 2b). For that reason, the loss of this study was only 21.40% of the assertions, i.e., A1, A10 and A14 showed linear correlation lower than 0.30. According to Wakita et al (2012), the loss of up to 40% of the total statements is considered adequate when using the Likert scale. Moreover, the results indicate the quality of content validation, considering aspects such as adequacy of phraseology, objectivity and assertiveness in the propositions presented. Considering only these 11 validated assertions, the overall main of the instrument was 3.35 points (SD = 0.36) (Table 2c), which demonstrates a positive student perception of the evaluated object.

The tested hypothesis was confirmed, and thus, in line with previous studies (e.g., CARR AND BARRY, 2020; CARR., 2021; LÓPEZ et al., 2021; SINNAYAH *et al.*, 2021; PLOETZNER, 2022; JACOB AND CENTOFANTI, 2023; VONTI AND HIDAYATI, 2023), the most students reported positive and motivating experiences after having studied EE through H5P interactive resources. For instance, several and recent studies have demonstrated that active learning through high quality interactive content has a more significant positive impact on learning outcomes than just reading and/or watching videos (both considered non-interactive learning contents) (CARR AND BARRY, 2020; FORONDA *et al.*, 2020; CARR., 2021; PLOETZNER, 2022; JACOB AND CENTOFANTI, 2023). Corroborating with these authors, the assertions A3 (3.69 points; DV: 0.60) and A4 (3.63 points; DV=0.61), both from dimension (D1) (Tables 1 and 2a), demonstrate that most students agreed that compared to traditional study (that is, through a booklet and video lessons), studying through H5P interactive resources makes it easier for students to absorb the content and their learning becomes efficient, dynamic, interesting, and accelerated.

Table 2. Results of the means values (MV) and Standard Deviations (SD), used for the verification of data behaviour and its dispersion based on the following definitions: (i) From 1.00 to 1.99 points: Poor perception of the evaluated object; (ii) From 2.00 to 2.99 points: Overall positive perception of its implementation; (iii) From 3.00 to 4.00 points: Positive perception of the evaluated object; and (iv) SD acceptable: <1.5 points. Moreover, to measure the reliability of the instrument, Spearman-Brown coefficient was applied. Firstly, the "r" was calculated in **Table 2a**: Dimension: D1 (Assertions: A1-A7) and in **Table 2b**: D2 (A8-A14), aiming at their eliminating assertions with a linear correlation lower than 0.30. Afterwards, the "r" was calculated again, considering only the assertions validated in the first administration. In this last step, only assertions with a linear correlation of less than 0.20, were eliminated. Only assertion A1 (D1) and assertions A10 and A14 (D2), were not validated. **Table 2c** presents the results of the overall mean and the overall standard deviation (A1-A14). Note: (*) does not accord the criterion r≥0.30.

Table 2a

Dimensions (D)	Assertions (A)	First administration			Second administration (Final result)		
		MV	SD	r	MV	SD	r
D1	A1	3.88	1.26	0.28*	**Not validated**		
D1	A2	2.74	0.60	0.74	2.74	0.60	0.78
D1	A3	3.69	0.61	0.42	3.69	0.61	0.40
D1	A4	3.63	1.03	0.35	3.63	1.03	0.31
D1	A5	3.07	0.53	0.77	3.07	0.53	0.80
D1	A6	3.73	1.19	0.42	3.73	1.19	0.38
D1	A7	2.96	3.62	0.70	2.96	3.62	0.74

Table 2b

Dimensions (D)	Assertions (A)	First administration			Second administration (Final result)		
		MV	SD	r	MV	SD	r
D2	A8	3.79	0.49	0.51	3.79	0.49	0.49
D2	A9	3.09	1.13	0.75	3.09	1.13	0.75
D2	A10	3.46	0.76	0.21*	**Not validated**		
D2	A11	3.65	0.63	0.46	3.65	0.63	0.40
D2	A12	3.25	1.02	0.74	3.25	1.02	0.75
D2	A13	3.29	1.10	0.70	3.29	1.10	0.73
D2	A14	3.32	1.01	0.22*	**Not validated**		

Table 2c

Dimensions (D)	Assertions (A)	First administration	Second administration (Final result)
D1 + D2	Overall mean (A1-A14)	3.40	3.35
	Overall SD (A1-A14)	0.35	0.36

Regarding assertion A6 (Tables 1 and 2a) (3.73 points; and DV: 0.53), most students agreed that the different interactive questionnaires (e.g., “multiple choice", "true or false", "fill in the blanks", "drag the words", "mark the words" and "drag and drop), combined with other interactive features facilitate learning. Spontaneous testimonial from “N.A.O” a student of Biological Sciences (sent by email) confirms the results of assertion A6. She wrote: "[...] *I liked the exercises* [...]. […] *The exercises help us to check our understanding and fixing the content* […]. These results are in conformity to study from Sinnayah *et al.* (2021), who investigated the use of H5P interactive resources during physiology education and found that 90% of the students who attempted the interactive questionnaires (e.g., fill-in-the-blank, and multiple-choice questions) indicated that their level of content knowledge was significantly improved.

Regarding assertions A2 and A5 (both negative assertions) (Tables 1 and 2a), it was believed that total disagreement would be prevalent. In fact, the students tended to disagree most of the time, with (i) 2.74 points; SD=1.26; and (ii) 3.07 points; SD =1.03, respectively. Therefore, corroborating the study by Jacob and Centofanti (2023), the results of assertive A2 indicate that students found that different H5P interactive resources, are not complex, and thus had helped them to understand the content better. Specifically, about assertion A5 (which discusses the benefits of using images), spontaneous testimonial from “E.P.S”, a Pedagogy student (sent by email) confirms the results of this assertion. She wrote: [...] *I'm really enjoying it* [...]. [...] *The content is VERY GOOD* [...]. [...] *I must praise the use of figures, photos, illustrations (e.g., pictures of animals, plants, rivers, landscapes of the biome). They make the text lighter, more pleasant, enlightening, and didactic* [...]. In this context, Lin and Wang (2012) and Cheng (2020) explains that when student satisfaction regarding course content and design is high, they are in turn more likely to engage further within the virtual learning environments (VLE).

Regarding D2 (subject: motivation), the use of interactive video during the teaching and learning process deserves to be highlighted. The assertions A8 (3.79 points; DV=0.49); A9 (3.09 points; DV= 1.13), and A11 (3.65 points; DV= 0.63) (Tables 1 and 2b), demonstrate students' satisfaction when using this interactive resource. Interactive videos they are innovating engagement tools, able to stimulate students' critical thinking, besides encourage autonomous learning (SPANJERS *et al.,* 2010; WILKIE *et al.,* 2018; JACOB AND CENTOFANTI, 2023). One of the advantages of interactive content video, is that it can be paused to incorporate interactive questionnaires (e.g., "multiple choice", "true or false", "fill in the blanks", "drag the words", "mark the words" and "drag and drop), which allows students to apply their understanding of presented concepts in a logical, meaningful manner (SPANJERS *et al.,* 2010; JACOB and CENTOFANTI, 2023). Corroborating the results of assertion A8, Wilkie et al. (2018), Zeller et al. (2021) and Ploetzner (2022) found that interactive videos, are more effective for didactic content retention and comprehension than videos without interactions. Again, spontaneous testimonial from "N.A.O", a student of Biological Sciences confirms the results of those three assertions. She wrote: [...] *I found the videos very didactic* [...] *The short duration (up to 5 minutes) is an incentive to watch them* [...].

The volunteer students also made some spontaneous criticisms about this research (sent by email). It is important to mention that many of criticisms are related to failures in the configuration of activities by professors (which demonstrates that students actually carried out the H5P simulations), e.g.,: (i) "E.P.S" - Pedagogy student: [...] *the activity about Brazilian Biomes is incorrectly configured* [...]; (ii) "E.A.C" - Pedagogy student: [...] *In some cases, the font size was too small. I had trouble viewing some activity. There should be some question in the questionnaire to assess this aspect* [...]; (iii) "N.A.O" - Biological Sciences student - [...] *So far, I've only had difficulty dragging and fixing the names of Humboldt and Odum on the Ecologists' Questionnaire* […].

2.4 Conclusion

Based on a quantitative, descriptive, and cross-sectional study, an evaluation of the perception of 122 volunteer DL undergraduate students from a private Brazilian HEI, about the use of H5P Moodle interactive content during the teaching and learning process of the EE was carried out. Firstly, these students compared the VLE Moodle traditional didactic resources (i.e., booklet plus non-interactive video lessons) versus several H5P

Moodle interactive resources (e.g., interactive videos, presentations, virtual tours 360, games, quizzes, flashcards, among others). Specifically, the subject studied was "concepts of Ecology". Soon after, they answered an instrument comprised two analysis dimensions (i.e., Feasibility and Motivation) consisting of 14 assertions of the Likert-type. The results obtained are summarised below:

(i) The most part of participating students (i.e., 99 among those 122) were from Pedagogy and Public Management courses.

(iii) The study on the reliability of the instrument resulted in a coefficient equal to 0.80. Therefore, it is possible to state that on another occasion, these students would respond to the instrument in the same way.

(iii) The number of validated assertions was 11/14 (a loss of the 21.40% of the assertions). However, the loss of up to 40% of the total statements is considered adequate when using the Likert scale.

(iv) The overall main of the 11 assertive instrument was 3.35 points (SD = 0.36), which demonstrates a positive student perception of the evaluated object.

(v) In line with previous studies, majority part of students reported positive and motivating experiences after having studied EE through H5P interactive resources.

H5P technology proved to be a cost-effective way to embed interactive activities in the VLE Moodle. For instance, in Brazil (which have strong budget constraints for education) there are more than 3.0 million students enrolled in DL courses. Therefore, this study can encourage Brazilian educators and/or instructional designers to create a variety of interactive H5P Moodle-based learning objects.

Moreover, H5P Moodle technology proved as an efficient method for the teaching and learning process of the cross-cutting theme EE. Since there are over 290 million Moodle users worldwide, the use of that plugin at private and public HEIs, can contribute worldwide students to acquire the knowledge and skills needed to promote sustainable development (according to Target 4.7 of SDG4 by UN).

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Ethics Statement

This study was approved by the Ethics Research Committee of the Metropolitan University of Santos (UNIMES) - opinion n. 5.788.781, and by the system CEP/CONEP - CAAE n. 63995822.7.0000.5509. Participation in the study was voluntary, and

participants could withdraw from the survey at any point. The online survey was completely anonymous and does not contain any information allowing identifying the participant.

CRediT author statement

Vinicius Roveri: Conceptualization; Data curation; Formal analysis; Methodology; Writing - original draft. **Simone Caivano**: Data curation; Formal analysis; Methodology; Writing - review & editing. **Luis Borges Gouveia**: Supervision; Writing - review & editing.

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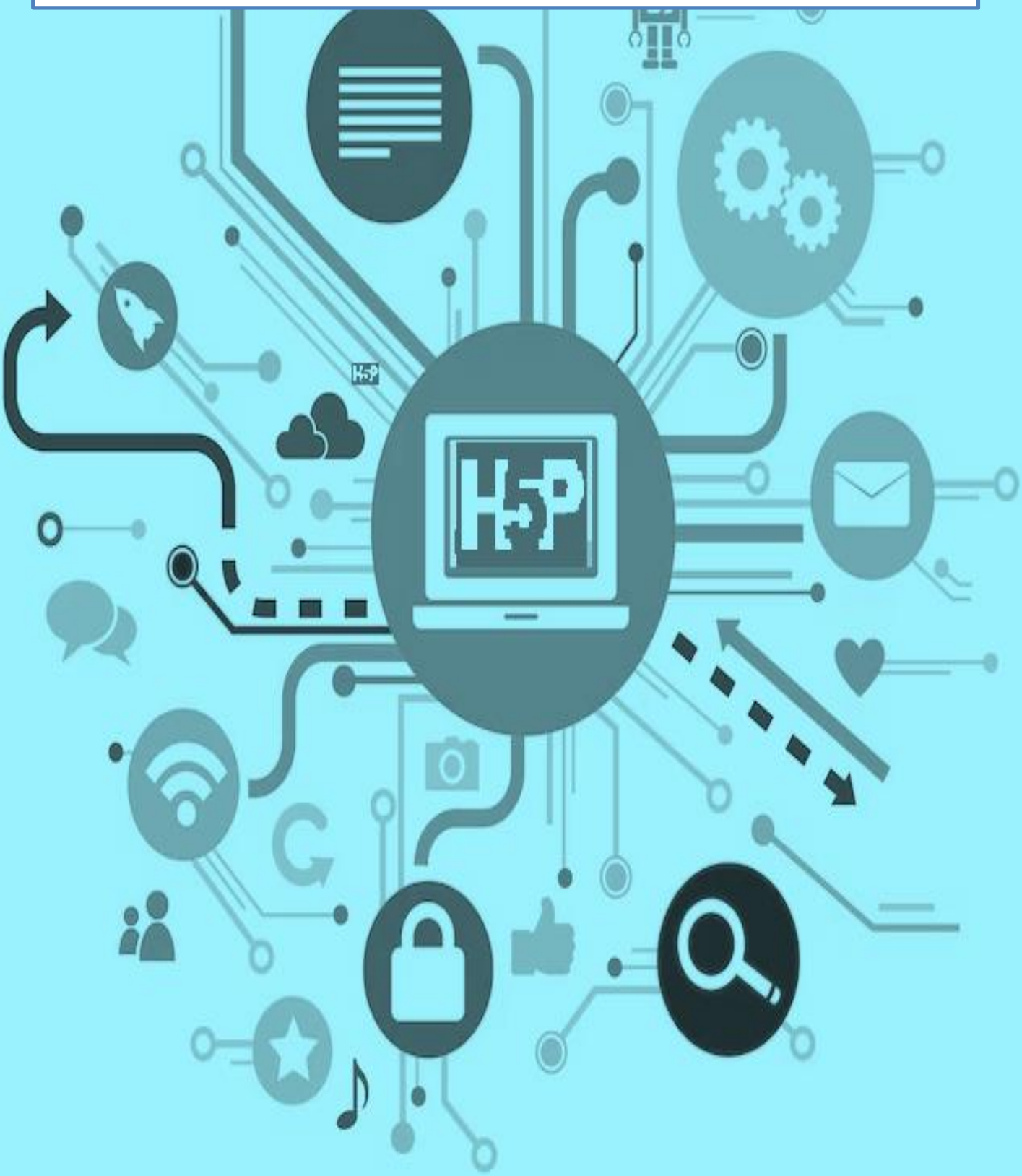
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CHAPTER III - Dataset on the profile and the perceptions of undergraduate learning students towards use H5P interactive content during the teaching and learning process on the distance education



Dataset on the profile and the perceptions of undergraduate learning students towards use H5P interactive content during the teaching and learning process on the distance education

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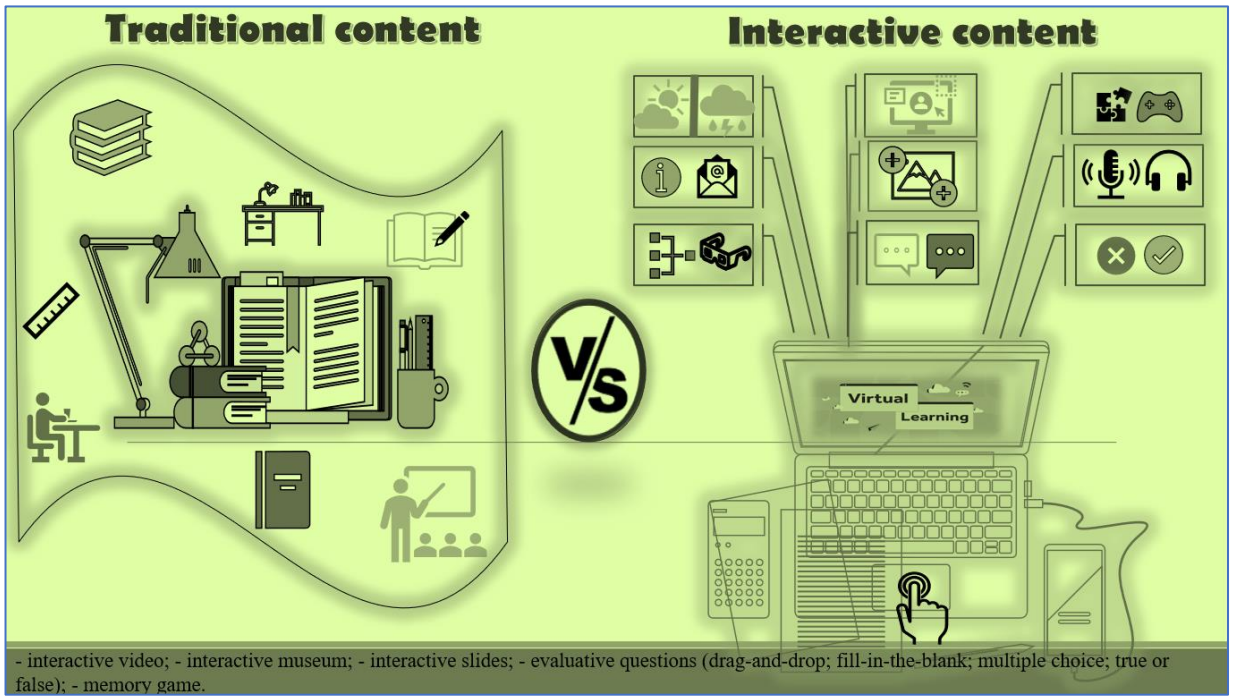
Graphical Abstract



Abstract

This paper presents dataset on profile, besides perception of 122 distance undergraduate learning students from a higher education institutions private Brazilian about the use of H5P Moodle interactive content during the teaching and learning process of the environmental education (EE). Firstly, the 122 students compared the virtual learning environment VLE Moodle traditional didactic resources (i.e., booklet plus non-interactive video lessons) versus several H5P Moodle interactive resources [namely, Collage; (ii) Timeline; (iii) Drag and Drop; (iv) Accordion; (v) True/False questions; (vi) Image slider; (vii)Find the Hotspot; (viii) Fill in the Blanks; (ix) Memory Game; (x) Image Juxtaposition; and (xi) Virtual Tour (360), among others]. Specifically, the subject studied was “concepts of Ecology”. Soon after, they answered an instrument comprised two analysis dimensions (D) (i.e., D1: Feasibility and D2: Motivation) consisting of 14 questions of the Likert-type. Both research steps were accessed via the Moodle LMS. The student’s participation was completely voluntary, anonymous and did not include any information that could have revealed their identities, to protect their privacy. There were no exclusion criteria. Besides, each student was allowed to complete the questionnaire once. Ultimately, multiple statistical comparisons were performed. For instance, to test

whether there is a significant correlation between dimensions D1 and D2, the Canonical correlation analysis was use. In addition, to test whether there is a significant correlation between questions (Q1-Q14), Spearman Rank Order correlation was use. Ultimately, in order to test if there are differences in opinions between students, regarding the variables: (a) gender; (b) academic majors; (c) grade level; and Brazilian regions they inhabit, three statistical tests were performed, namely: (a) the independent samples t test; (b) the Fisher's statistic; and (c) the Tukey's posterior test. The availability of this dataset as an open access dataset will provide educational policymakers, and mainly academics with a better understanding of the perceptions of distance undergraduate learning students towards use H5P interactive content, allowing them to make more informed decisions during the teaching and learning process on the distance education mode.

Keywords: Active Learning; Computer-Assisted Learning; Playful learning; Plugin H5P; Virtual learning environments; Sustainability education.

Specifications Table

Subject area	Education.
Specific subject area	Active Learning; Computer-Assisted Learning; Playful learning; Plugin H5P; Virtual learning environments; Sustainability education.
Type of data	Videos in MP4 format; Survey Instrument; Table and Charts.
How the data were acquired	The data was acquired through students answers a google questionnaire accessed via the Moodle Learning Management System (Moodle LMS).
Data format	Raw and analysed.
Description of data collection	Firstly, the 122 distance undergraduate learning students from a higher education institution private Brazilian, compared the virtual learning environment VLE Moodle traditional didactic resources versus several H5P Moodle interactive resources. Specifically, the subject studied was “concepts of Ecology”. Soon after, they answered an instrument comprised two analysis dimensions (D) (i.e., D1: Feasibility and D2: Motivation) consisting of 14 questions of the Likert-type. Both research steps

	were accessed via the Moodle LMS. The student's participation was completely voluntary, anonymous and did not include any information that could have revealed their identities, in order to protect their privacy. There were no exclusion criteria. Besides, each student was allowed to complete the questionnaire once. Ultimately, multiple statistical comparisons were performed. For instance, to test whether there is a significant correlation between both dimensions and between the 14 Likert-type questions; besides to test if there are differences in opinions between students, regarding the variables: (i) genders; (ii) academic majors; (iii) grade level; and (iv) Brazilian regions they inhabit.
Data source location	Institution: Metropolitan University of Santos (UNIMES): https://portal.unimes.br/ Region: Bahia State; Mato Grosso State; Minas Gerais State; Santa Catarina State; São Paulo State. Country: Brazil.
Data accessibility	Repository name of the videos: Mendeley Data. Data identification number: 10.17632/597333hvjv.6 Direct URL to data: https://data.mendeley.com/datasets/597333hvjv/6
Related research article	Roveri, Roveri, V. Caivano, S. Gouveia, B. L. Perceptions of distance undergraduate learning students towards use H5P interactive content during the teaching and learning process of the environmental education. Revista Paidei@, UNIMES Virtual, Volume 15, Número 27, Abr. 2023. p. 05-26.

Value of the Data

- The data presented in this article revealed distance undergraduate learning students' perception about the use of emerging technologies, such as the H5P plugin, that could be used to improve the interactivity in virtual learning environments (e.g., the Moodle LMS).

- The dataset could be used as a yardstick to formulate educational policies for distance undergraduate learning students' continuously engagement in virtual learning environment VLE (such as Moodle LMS).

- The dataset presented could be encourage educators and/or instructional designers to create a variety of interactive H5P Moodle-based learning objects.

- According to Target 4.7 of Sustainable Development Goals (SDG4) by UN, the dataset will be useful for higher education leaders to innovate practices to enhance institutionalisation of sustainability education.

- The dataset provides raw data as well as multiple statistical comparisons that can be added to new datasets and also compared to data obtained from similar studies conducted in other countries, regions and/or universities.

3.1 Objective

The aim of this dataset is to provide information on the profile, besides perception of 122 distance undergraduate learning students from a higher education institutions private Brazilian about the use of H5P Moodle interactive content during the teaching and learning process of the environmental education (EE).

3.2 Data description

Section 3.1 contains demographic information (including the variables gender, grade level, academic majors, besides living region), on the 122 distance undergraduate learning students from UNIMES (a higher education institutions private Brazilian; see more details in Table 1).

Table 1. Descriptive demographic analysis (including Frequency; Percentage; and Cumulative percentage).

Variable	Frequency	Percentage	Cumulative Percentage
Gender			

Female	107	87.7	87.7
Male	15	12.3	100.0
Total	122	100.0	
Major or specialisation			
Business and Management	25	20.5	20.5
Educational science and teacher training	81	66.4	86.9
Health	2	1.6	88.5
Life Science and Nature Science	11	9.0	97.5
Statistics, Engineering and Computer & IT	3	2.5	100.0
Total	122	100.0	
Grade Level			
First-year	49	40.2	40.2
Second year	36	29.5	69.7
Third year	33	27.0	96.7
Fourth year	4	3.3	100.0
Total	122	100.0	
Living Region in Brazil			
Bahia State	12	9.8	9.8
Mato Grosso State	10	8.2	18.0
Minas Gerais State	37	30.3	48.4
Santa Catarina State	8	6.6	54.9
São Paulo State	55	45.1	100.0
Total	122	100.0	

Section 3.2 contains the description of the steps of the comparative study between both teaching methodologies (i.e., use of Moodle traditional didactic resources versus use of H5P interactive resources) (see more details in Table 2). Firstly, the 122 voluntary students studied environmental education subject. However, this study was developed in VLE Moodle through the following traditional didactic resources, namely: (i) reading a handout; and (ii) video lessons (both prepared by the professor). Specifically, the subject studied was “concepts of Ecology” (see more details in Video 0) (ROVERI, 2023). From this first experience, these students were allocated in another VLE Moodle virtual classroom, which was prepared with H5P interactive resources. Among resources, highlight to: (i) Collage; (ii) Timeline; (iii) Drag and Drop; (iv) Accordion; (v) True/False questions; (vi) Image slider; (vii)Find the Hotspot; (viii) Fill in the Blanks; (ix) Memory Game; (x) Image Juxtaposition; and (xi) Virtual Tour (360). In this way, these students carried out H5P interactive activities with the same theme addressed in the traditional didactic resources (see more details in Videos 1-15) (ROVERI, 2023).

Table 2. Description and details of the steps of the comparative study, i.e.: (i) Moodle traditional didactic resources; versus (ii) H5P interactive resources. The Videos 0-15 can be found at Mendeley Data (ROVERI, 2023).

1st part of the study (from August to November 2022)	**Subject studied**			**Details**
	Moodle traditional didactic resources	Firstly, these 122 students studied environmental education subject during the 2nd semester of 2022. However, this study was developed in VLE Moodle through the following traditional didactic resources, namely: (i) reading a handout; and (ii) video lessons (both prepared by the professor). Specifically, the subject studied was "concepts of Ecology".		See more details in Video 0 (ROVERI, 2023)
2nd part of the study (from December 2022 to February 2023)	**Subject studied**			**Details**
	Presentation of the research objectives	From this first experience, these students were allocated in another VLE Moodle virtual classroom, which was prepared with H5P interactive resources. In this way, the students had access to the following contents: (i) information about study casuistry; (ii) class topic 1: the main ecologists; (iii) class topic 2: Ecology and Ecosystems; (iv) class topic 3: Brazilian Biomes and, finally, to Perception`s questionnaire.		See more details in Video 1 (ROVERI, 2023)
3rd part of the study (from December 2022 to February 2023)	**H5P interactive resources (subject studied)**	**Class topic**	**H5P content used**	**Details**
	Concepts of Ecology	The main Ecologists	Collage. Collage is a free HTML5 based photo content type allowing users to set up multiple photos in a custom layout.	See more details in Video 2 (ROVERI, 2023)
	Concepts of Ecology	The main Ecologists	Timeline. Timeline is a free HTML5 based content type allowing creatives to create interactive timelines	See more details in Video 2 (ROVERI, 2023)
	Concepts of Ecology	The main Ecologists	Drag and Drop. Drag and Drop is a free HTML5-based drag and drop question type	See more details in Video 3 (ROVERI, 2023)
	Concepts of Ecology	Ecology and Ecosystems	Accordion. The Accordion content type allows users to add accessible accordions to VLE Moodle.	See more details in Video 4 (ROVERI, 2023)
	Concepts of Ecology	Ecology and Ecosystems	True/False Question. A free HTML5 based content type allowing designers and professors to create true/false questions.	See more details in Video 5 (ROVERI, 2023)
	Concepts of Ecology	Brazilian Biomes	Image slider. A Free HTML5-based image slider allowing designers and professors to create responsive image sliders with a full-screen mode in a user-friendly way.	See more details in Videos 6 and 8 (ROVERI, 2023)
	Concepts of Ecology	Brazilian Biomes	Find the Hotspot. A free HTML5 based question type allowing designers and professors to create an image-based test where the learner is to find the correct spots on an image.	See more details in Videos 7 and 9 (ROVERI, 2023)

	Concepts of Ecology	Brazilian Biomes	Fill in the Blanks. A free HTML5 based question type allowing designers and professors to create fill in the blanks, also known as cloze tests.	See more details in Video 10 (ROVERI, 2023)
	Concepts of Ecology	Brazilian Biomes	Memory Game. A free HTML5-based memory game content type allowing designers and professors to add their own images (and optional text) to a memory game.	See more details in Video 11 (ROVERI, 2023)
	Concepts of Ecology	Brazilian Biomes	Image Juxtaposition. A free HTML5-based image content type that allows users to compare two images interactively	See more details in Videos 12, 13 and 14 (ROVERI, 2023)
	Concepts of Ecology	Brazilian Biomes	Virtual Tour (360). A free HTML5 based virtual tour content type allowing designers and professors to add questions, texts and interactions to multiple 360 environments using only a web browser.	See more details in Video 15 (ROVERI, 2023)

After the comparison between both teaching methodologies, the students answered the perception`s questionnaire. Therefore, **Section 3.3** contains data of the Google form questionnaire. This questionnaire (instrument) applied to evaluate the "perceptions of 122 distance undergraduate learning students towards use H5P interactive content during the teaching and learning process of the environmental education". The instrument comprised two analysis dimensions consisting of 14 questions of the Likert-type. The analysis dimensions (D) were: (D1) Feasibility in the use of H5P Moodle interactive resources to promote the EE teaching-learning process in DL [questions (Q): Q1,Q2, Q3, Q4, Q5, Q6 and Q7]; and (D2): Motivation of students to study with the support of the H5P plugin [questions (Q): Q8, Q9, Q10, Q11, Q12, Q13 and Q14]. To ensure the legitimacy and consistency of the responses, similar assertions were used, in addition to interspersing positive (e.g., Q1, Q3, Q4, Q6, Q8, Q10, Q11 and Q14), and negative assertions (e.g., Q2, Q5, Q7, Q9, Q12 and Q13). See more details in Table 3 and Figure 1. Moreover, to measure the internal consistency of the instrument (i.e., reliability), Cronbach's alpha coefficient was applied (Table 3).

Table 3. Instrument applied to evaluate the "perceptions of 122 distance undergraduate learning students towards use H5P interactive content during the teaching and learning process of the environmental education". The instrument comprised two analysis dimensions [(D1) Feasibility and (D2) Motivation] consisting of 14 questions of the Likert-type. To ensure the legitimacy and consistency of the responses, similar questions were used, in addition to interspersing positive (e.g., Q1, Q3, Q4, Q6, Q8, Q10, Q11 and Q14), and negative questions (e.g., Q2, Q5, Q7, Q9, Q12 and Q13). Note: Numerical

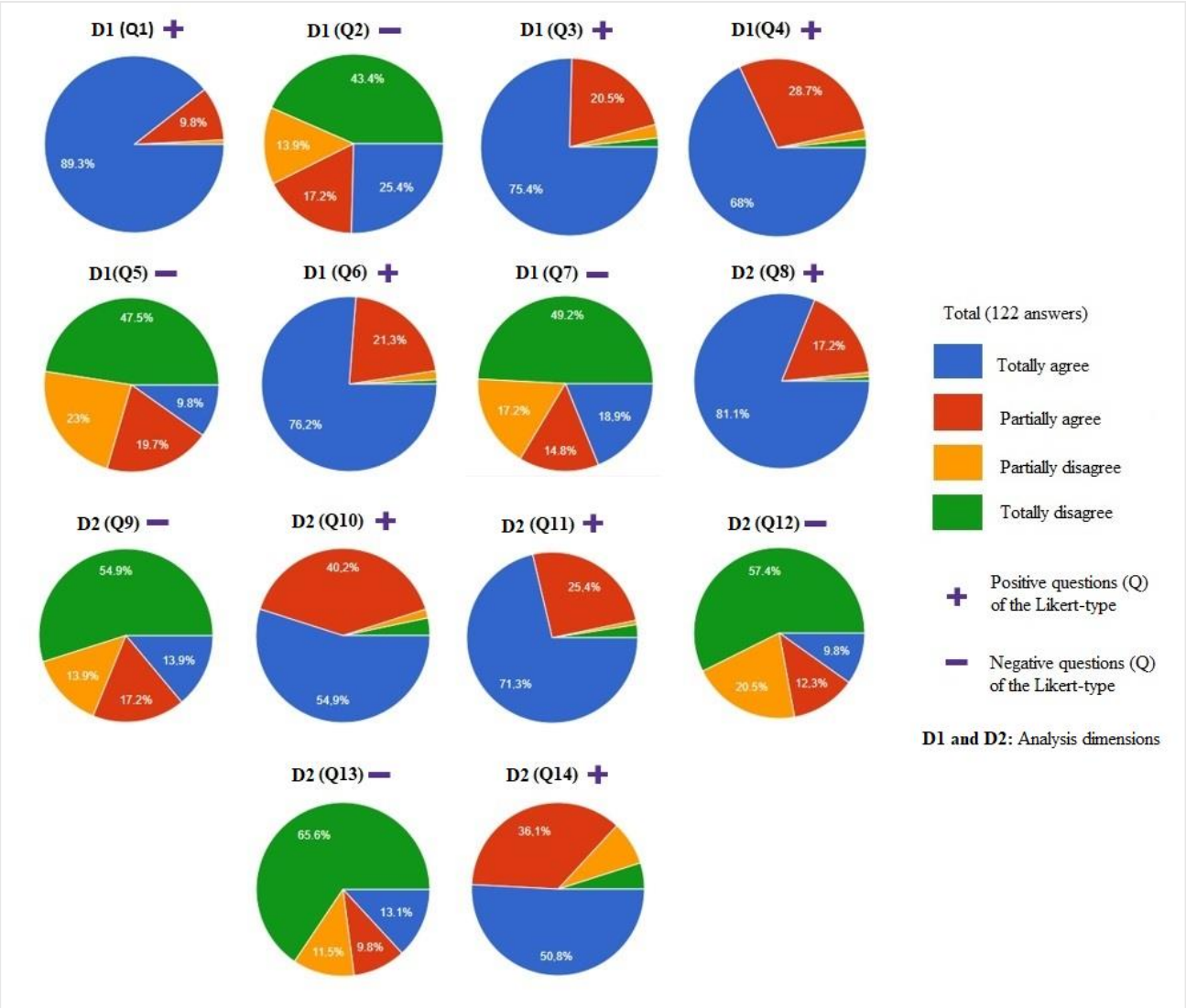
values that indicates the answer possibilities: *a*=positive: (4) Completely agree, (3) Agree in most cases, (2) Disagree in most cases, (1) Completely disagree; *b*=negative: (1) Completely disagree, (2) Disagree in most cases, (3) Agree in most cases, (4) Completely agree. The reliability study showed that both dimensions (D1 and D2) have low Cronbach's alpha value (i.e.: values from 0.41 to 0.60). Therefore, both indicated moderate internal consistency.

Questions of the Likert-type				**Reliability study (Cronbach's alpha)**				
Dimensions (D)	**Questions (Q)**	**Questions description**	**Question types**	**N**	**Average**	**Standard deviation**	**Cronbach's alpha value**	**Internal consistency**
D1	Q1	The gamification (I) proposed by some activities transforms written content into more accessible materials and therefore facilitates learning. (I) Gamification: activity that refers to a game/simulation ***a***.	Positive	122	1.11	0.310	0.474	Moderate
D1	Q2	Some interactive contents (II) are highly complex and, therefore, make learning difficult. (II) Interactive content: examples are: (a) interactive video; (b) interactive museum; (c) interactive slides; (d) evaluative questions (drag-and-drop; fill-in-the-blank; multiple choice; true or false); (e) memory game, among other contents ***b***.	Negative	122	2.78	1.250	0.474	Moderate
D1	Q3	With the use of different interactive resources, merely expository contents (such as a handout) were transformed into something dynamic and interesting ***a***.	Positive	122	1.28	0.549	0.474	Moderate
D1	Q4	Compared to traditional study (that is, through a booklet and video lessons), studying through interactive resources makes it easier for	Positive	122	1.34	0.557	0.474	Moderate

		students to absorb the content and their learning becomes efficient and accelerated ***a***.						
D1	Q5	After using different interactive resources, the virtual learning environment became visually polluted (excess images), making learning difficult ***b***.	Negative	122	3.09	1.029	0.474	Moderate
D1	Q6	The different knowledge tests (e.g., multiple choice or true and false questions), combined with different interactive features, facilitate learning ***a***.	Positive	122	1.27	0.531	0.474	Moderate
D1	Q7	Although the "memory game" works on concentration and the development of students' quick thinking, this ludic didactic resource (iii) is not suitable for higher education. (iii) Ludic: Way to develop creativity, knowledge, through games. The aim is to educate, teach, having fun ***b***.	Negative	122	2.95	1.205	0.474	Moderate
D2	Q8	Studying with the support of different interactive contents is more motivating than studying through traditional material (example, handout + video lesson) ***a***.	Positive	122	1.21	0.485	0.530	Moderate
D2	Q9	Carrying out studies, through interactive video, has become less intuitive and interesting ***b***.	Negative	122	3.07	1.144	0.530	Moderate
D2	Q10	The interactive contents are very attractive and, therefore, increase the students' attention ***a***.	Positive	122	1.53	0.706	0.530	Moderate

D2	Q11	The study, carried out with the support of different interactive resources [e.g., interactive video and virtual tour (360)], makes the student more active and engaged in the teaching and learning process ***a***.	Positive	122	1.35	0.655	0.530	Moderate
D2	Q12	The gamification proposed by some activities reduces attention to the studied content ***b***.	Negative	122	3.28	0.998	0.530	Moderate
D2	Q13	Studying with the support of different interactive resources makes studying more boring ***b***.	Negative	122	3.31	1.076	0.530	Moderate
D2	Q14	Studying with the support of an "interactive video" is more stimulating than watching a video lesson recorded by the teacher, because it helps to maintain attention on certain subjects considered monotonous ***a***.	Positive	122	1.65	0802	0.530	Moderate

Figure 1. Data of the Google form questionnaire applied to evaluate the "perceptions of 122 distance undergraduate learning students towards use H5P interactive content during the teaching and learning process of the environmental education". The instrument comprised two analysis dimensions consisting of 14 questions of the Likert-type. The analysis dimensions (D) were: (D1) Feasibility [questions (Q): Q1-Q7]; and (D2): Motivation (questions Q8-Q14). To ensure the legitimacy and consistency of the responses, similar questions were used, in addition to interspersing positive (e.g., Q1, Q3, Q4, Q6, Q8, Q10, Q11 and Q14), and negative questions (e.g., Q2, Q5, Q7, Q9, Q12 and Q13). Note: Totally agree (Blue square), Partially agree (Red square), Partially disagree (Yellow square), Totally disagree (Green square). See more details in Table 3. It is important to mention that this dataset have already been widely discussed in the paper entitled "Perceptions of distance undergraduate learning students towards use H5P interactive content during the teaching and learning process of the environmental education" by Roveri, V. Caivano, S. Gouveia, B. L. (see more details in **Specifications Table**).



Still in **Section 3**, multiple statistical comparisons were performed. Firstly, to test whether there is a significant correlation between dimensions D1 and D2, the Canonical correlation analysis was use (Table 4). In addition, to test whether there is a significant correlation between questions (Q1-Q14), Spearman Rank Order correlation was use (Table 5). Ultimately, in order to test if there are differences in opinions between students, regarding the variables: (a) gender (Table 6 and Figure 2); (b) academic majors (Table 7); (c) grade level (Table 8 and Figure 3); and Brazilian regions they inhabit (Table 9 and Figures 4, 5 and 6), three statistical tests were performed, namely: (a) the independent samples t test; (b) the Fisher's statistic; and (c) the Tukey's posterior test.

Table 4. The Canonical analysis showed that there is a significant positive correlation (i.e., Canonical R=0.7844, p<0.0001) between dimensions D1 and D2.

	Canonical analysis

N=122	Dimension (D1)	Dimension (D2)
No. of variables	7	7
Variance extracted	100%	100%
Total redundancy	36.318%	39.093%
Variables (questions - Q)	Q1	Q8
	Q2	Q9
	Q3	Q10
	Q4	Q11
	Q5	Q12
	Q6	Q13
	Q7	Q14

Table 5. Spearman Rank Order analysis showed that there is a significant stats correlation (underlined values: $p<0.05$) between questions (Q1-Q14).

	Spearman Rank Order Correlations													
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**
Q1	1	-0.141	0.289	0.306	-0.209	0.309	-0.06	0.314	-0.153	0.169	0.138	-0.233	-0.313	0.162
Q2	-0.141	1	-0.215	-0.179	0.641	-0.097	0.556	-0.308	0.44	0.008	-0.167	0.482	0.457	0.039
Q3	0.289	-0.215	1	0.32	-0.26	0.412	-0.141	0.245	-0.113	0.155	0.227	-0.222	-0.13	0.3
Q4	0.306	-0.179	0.32	1	-0.247	0.406	-0.089	0.429	-0.162	0.403	0.2	-0.14	-0.071	0.239
Q5	-0.209	0.641	-0.26	-0.247	1	-0.272	0.52	-0.396	0.603	0.068	-0.248	0.533	0.486	0.054
Q6	0.309	-0.097	0.412	0.406	-0.272	1	-0.172	0.425	-0.135	0.334	0.411	-0.129	-0.215	0.328
Q7	-0.06	0.556	-0.141	-0.089	0.52	-0.172	1	-0.234	0.557	0.113	-0.207	0.529	0.475	0.023
Q8	0.314	-0.308	0.245	0.429	-0.396	0.425	-0.234	1	-0.311	0.291	0.398	-0.418	-0.386	0.06
Q9	-0.153	0.44	-0.113	-0.162	0.603	-0.135	0.557	-0.311	1	-0.12	-0.241	0.572	0.546	-0.005
Q10	0.169	0.008	0.155	0.403	0.068	0.334	0.113	0.291	-0.12	1	0.428	-0.024	0.018	0.494
Q11	0.138	-0.167	0.227	0.2	-0.248	0.411	-0.207	0.398	-0.241	0.428	1	-0.262	-0.247	0.35
Q12	-0.233	0.482	-0.222	-0.14	0.533	-0.129	0.529	-0.418	0.572	-0.024	-0.262	1	0.661	-0.008
Q13	-0.313	0.457	-0.13	-0.071	0.486	-0.215	0.475	-0.386	0.546	0.018	-0.247	0.661	1	0.08
Q14	0.162	0.039	0.3	0.239	0.054	0.328	0.023	0.06	-0.005	0.494	0.35	-0.008	0.08	1

Table 6. There are statistically significant differences between gender opinions. The female shows greater disagreement than male for questions Q4, Q6 and Q10 (underlined values). Note: (i) t-value (independent samples t test): the bigger it is, the more different the averages are; (ii) df: analysis degrees of freedom; (iii) statistical p value: whenever it is less than 0.05 there is statistical significance. See more details in Figure 2.

Variable (questions)	T-tests; Grouping: Gender				
	Mean Male	Mean Female	t-value (welch)	df	p
Q1	1.000	1.121	-3.829	106.000	0.0002
Q2	2.867	2.766	0.281	17.801	0.7821
Q3	1.133	1.299	-1.560	25.732	0.1310
Q4	1.067	1.383	-3.641	38.003	0.0008
Q5	2.800	3.131	-1.116	17.663	0.2792
Q6	1.000	1.308	-5.733	106.000	0.0000
Q7	3.000	2.944	0.151	17.118	0.8814
Q8	1.000	1.243	-4.919	106.000	0.0000

Q9	2.867	3.103	-0.645	16.763	0.5279
Q10	1.133	1.589	-3.967	34.108	0.0004
Q11	1.267	1.364	-0.724	23.653	0.4763
Q12	3.400	3.262	0.454	17.161	0.6556
Q13	3.533	3.280	0.915	19.070	0.3717
Q14	1.400	1.682	-1.555	21.212	0.1347

Figure 2. There are statistically significant differences between gender opinions. The female shows greater disagreement than male for questions Q4, Q6 and Q10. Note: (i) t-value (independent samples t test); (ii) df: analysis degrees of freedom; (iii) statistical p value; (iv) black and red circles, represent means for male and female, respectively. See more details in Table 5.

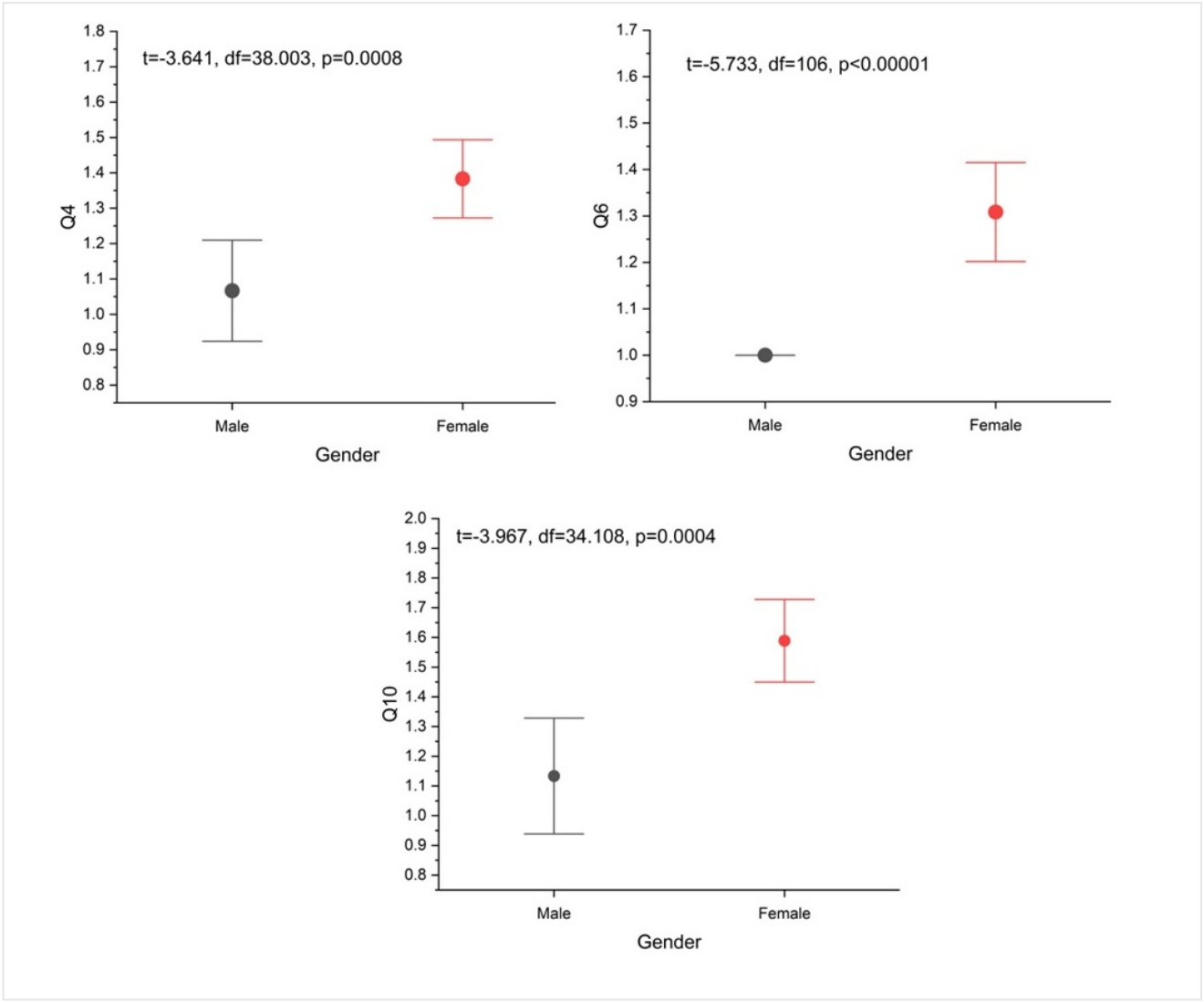


Table 7. There are no statistically significant differences between academic major`s opinions. Note: (i) Type III sum of squares: it represents a way of measuring variance in models; the more its value, the more significant differences there are between the averages being compared; (ii) df: Degrees of freedom; (iii) Mean square: is the sum of squares divided by degrees of freedom; (iv) F: Fisher's statistic: the farther from 1, the

more significant the result tends to be; (v) Partial eta squared: the closer to 1, the better separated are the groups; (vi) P: statistical p value.

Variable (questions)	Fisher's statistic; Grouping: academic majors					
	Type III Sum of Squares	df	Mean Square	F	Partial eta squared	p
Q1	0,720	4	0.180	1.932	0.062	0.10964
Q2	17,362	4	4.340	2.658	0.092	0.05273
Q3	0,633	4	0.158	0.516	0.017	0.72426
Q4	1,794	4	0.449	1.468	0.048	0.21637
Q5	16,098	4	4.024	4.008	0.126	0.05322
Q6	0,653	4	0.163	0.571	0.019	0.68401
Q7	15,043	4	3.761	2.339	0.086	0.06198
Q8	2,077	4	0.519	2.303	0.073	0.06260
Q9	8,937	4	2.234	1.750	0.056	0.14376
Q10	1,858[j]	4	0.465	0.929	0.031	0.44975
Q11	0,957	4	0.239	0.550	0.018	0.69932
Q12	5,531	4	1.383	1.407	0.046	0.23594
Q13	2,479	4	0.620	0.527	0.018	0.71629
Q14	3,530	4	0.882	1.389	0.045	0.24191

Table 8. There are statistically significant differences between students' opinions from different grade level, for questions Q6, Q10 and Q11 (underlined values). Note: (i) Type III sum of squares: it represents a way of measuring variance in models; the more its value, the more significant differences there are between the averages being compared; (ii) df: Degrees of freedom; (iii) Mean square: is the sum of squares divided by degrees of freedom; (iv) F: Tukey's posterior test; (v) Partial eta squared: the closer to 1, the better separated are the groups; (vi) P: statistical p value. See more details in Figures 3.

Variable (questions)	Tukey's posterior test; Grouping: Grade level					
	Type III Sum of Squares	df	Mean Square	F	Partial eta squared	p
Q1	0,292	3	0.097	1.015	0.02515	0.389
Q2	3,549	3	1.183	0.753	0.01878	0.523
Q3	1,207	3	0.402	1.344	0.03304	0.263
Q4	1,037	3	0.346	1.117	0.02762	0.345
Q5	1,239	3	0.413	0.384	0.00968	0.764
Q6	4,747	3	1.582	6.367	0.13933	<0.001
Q7	4,019	3	1.340	0.921	0.02287	0.433
Q8	0,100	3	0.033	0.138	0.00351	0.937
Q9	3,480	3	1.160	0.884	0.02198	0.452
Q10	6,424	3	2.141	4.684	0.10642	0.004

Q11	15,424	3	5.141	16.657	0.29750	0.000
Q12	5,308	3	1.769	1.812	0.04404	0.149
Q13	4,111	3	1.370	1.189	0.02933	0.317
Q14	7,641	3	2.547	4.281	0.09816	0.007

Figure 3. There are statistically significant differences between students' opinions from different grade level. Students from fourth year has much higher disagreement than students the other years for questions Q6, Q10 and Q11. Note: (i) F: Tukey's posterior test; (ii) P: statistical p value. (iii) black circles (first, second and third years) and red circles (fourth year), represent means values. See more details in Table 8.

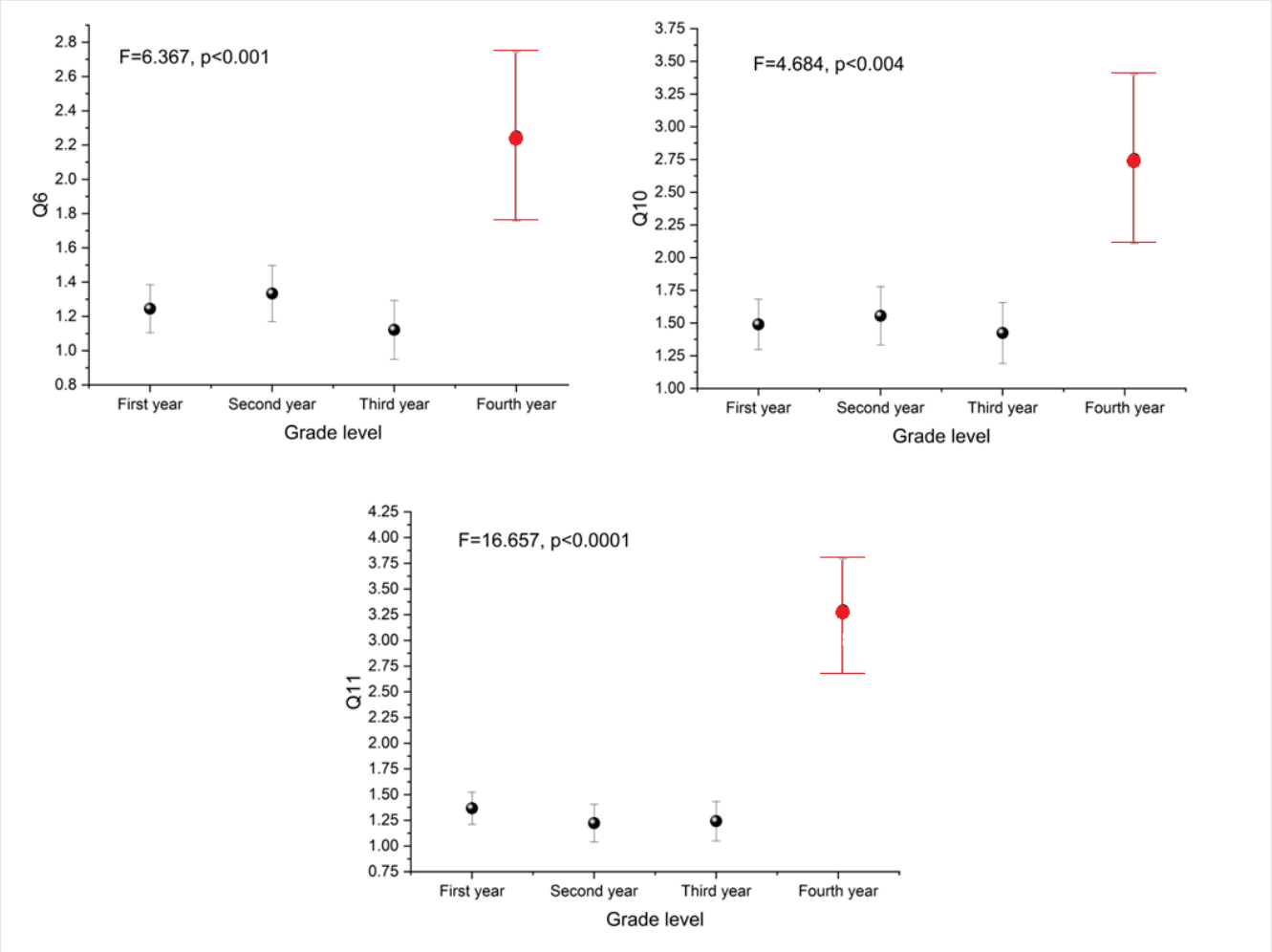


Table 9. There are statistically significant differences between student from different Brazilian regions opinions, for questions Q2, Q10 and Q11 (underlined values). Note: (i) Type III sum of squares: it represents a way of measuring variance in models; the more its value, the more significant differences there are between the averages being compared; (ii) df: Degrees of freedom; (iii) Mean square: is the sum of squares divided by degrees of freedom; (iv) F: Tukey's posterior test; (v) Partial eta squared: the closer to 1, the better separated are the groups; (vi) P: statistical p value. See more details in Figures 4, 5 and 6.

Variable (questions)	Tukey's posterior test; Grouping: Living Region in Brazil					
	Type III Sumo f squares	gl	Mean Square	F	Partial eta squared	p
Q1	0,571	4	0.143	1.514	0.049	0.203
Q2	20,320	4	5.080	3.523	0.107	0.009
Q3	0,721	4	0.180	0.589	0.020	0.671
Q4	2,024	4	0.506	1.667	0.054	0.162
Q5	0,815	4	0.204	0.187	0.006	0.945
Q6	1,372	4	0.343	1.227	0.040	0.303
Q7	12,713	4	3.178	2.281	0.072	0.065
Q8	0,656	4	0.164	0.690	0.023	0.600
Q9	3,656	4	0.914	0.691	0.023	0.599
Q10	5,051	4	1.263	2.671	0.084	0.036
Q11	5,603	4	1.401	3.544	0.108	0.009
Q12	6,482	4	1.620	1.662	0.054	0.163
Q13	2,729	4	0.682	0.581	0.019	0.677
Q14	2,000	4	0.500	0.771	0.026	0.546

Figure 4. There are statistically significant differences between student from different Brazilian regions opinions, for questions Q2. Students from Mato Grosso and Santa Catarina states has higher disagreement than students from São Paulo state. There is no statistically significant difference between the other states. Note: (i) F: Tukey's posterior test; (ii) P: statistical p value. (iii) black circles represent means values. See more details in Table 9.

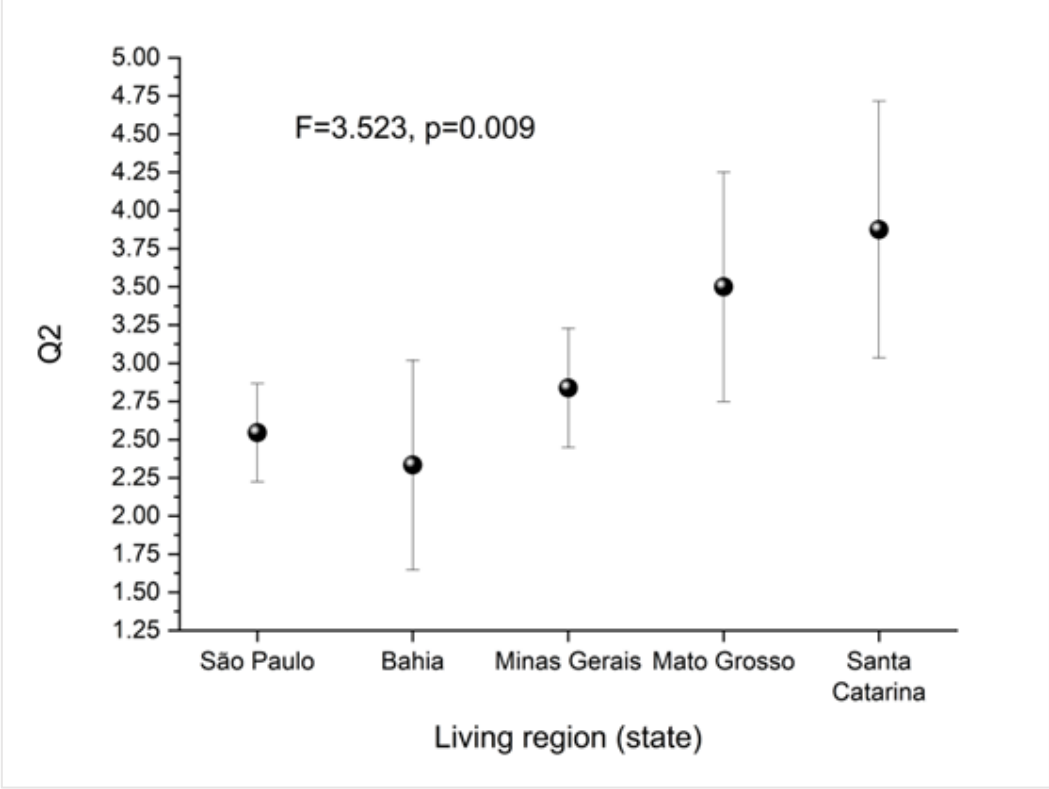


Figure 5. There are statistically significant differences between student from different Brazilian regions opinions, for question Q10. Students from Santa Catarina state has higher disagreement than students from other states. There is no statistically significant difference between the other states. Note: (i) F: Tukey's posterior test; (ii) P: statistical p value. (iii) black circles represent means values. See more details in Table 9.

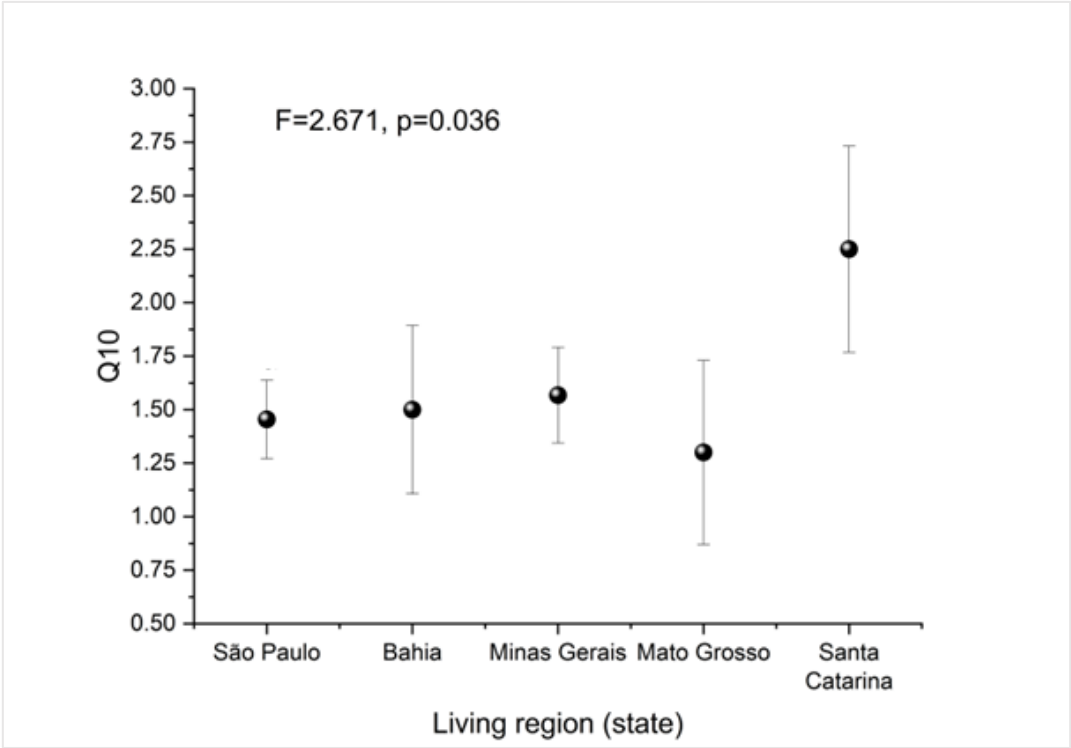
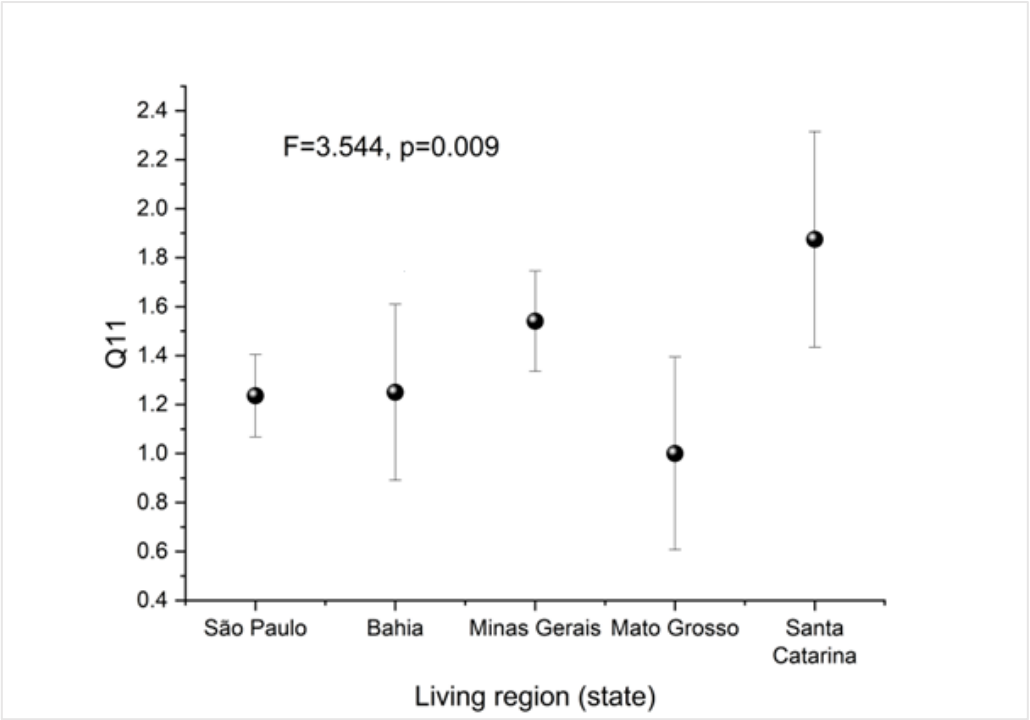


Figure 6. There are statistically significant differences between student from different Brazilian regions opinions, for question Q11. Students from Santa Catarina state has higher disagreement than students from São Paulo and Mato Grosso state. Moreover, students from Minas Gerais state have higher disagreement than students from São Paulo and Mato Grosso state. There is no statistically significant difference between the other states. Note: (i) F: Tukey's posterior test; (ii) P: statistical p value. (iii) black circles represent means values. See more details in Table 9.



3.3 Experimental design, materials, and methods

This survey was approved by the Ethics Research Committee of the Metropolitan University of Santos (UNIMES) - opinion n. 5.788.781, and by the system CEP/CONEP - CAAE n. 63995822.7.0000.5509. Prior to data collection, students had been informed that their participation in this survey was entirely voluntary and that they could leave at any time and for any reason, with no penalty. Furthermore, the content of their survey will be kept private, and the data collected will not contain any information that could be used to identify the students. All participants have voluntarily consented to participate. This is a quantitative, descriptive cross-sectional survey conducted among 122 DL undergraduate students (i.e., 107 female and 15 male) at UNIMES, and regularly enrolled in the EE discipline. In UNIMES, the EE is a cross-cutting theme, and offered as an elective discipline to all DL undergraduate courses. These students come from five specialisation (i.e., academic majors), namely (i) Business and Management, (ii) Educational science and teacher training, (iii) Health, (iv) Life Science and Nature Science, and (v) Statistics, Engineering and Computer & IT. Moreover, these voluntary students come from different grade, that is, form the first to fourth level. Since UNIMES has students throughout 10 Brazilian regions, these students living five states, i.e., (i) Bahia State; (ii) Mato Grosso State; (iii) Minas Gerais State; (iv) Santa Catarina State; and (v) São Paulo State. In summary, these volunteer students carried out the following

contributions to this research. Firstly, they compared the VLE Moodle traditional didactic resources (i.e., booklet plus non-interactive video lessons) versus H5P Moodle interactive resources [namely, (i) Collage; (ii) Timeline; (iii) Drag and Drop; (iv) Accordion; (v) True/False questions; (vi) Image slider; (vii)Find the Hotspot; (viii) Fill in the Blanks; (ix) Memory Game; (x) Image Juxtaposition; and (xi) Virtual Tour (360), among others]. Specifically, the subject studied was “concepts of Ecology”. Ultimately, they answered the questionnaire about the “perceptions of distance undergraduate learning students towards use H5P interactive content during the teaching and learning process of the environmental education". Both research steps were accessed via the Moodle LMS, and they were conducted during December 02, 2022, to February 02, 2023. There were no exclusion criteria. Besides, each student was allowed to complete the questionnaire once. The analysis instrument construction (questionnaire) followed the methodology of Caivano and Domene (2020). The instrument comprised two analysis dimensions consisting of 14 questions of the Likert-type (WAKITA et al., 2012). The analysis dimensions (D) were: (D1) Feasibility in the use of H5P Moodle interactive resources to promote the EE teaching-learning process in DL; questions (Q): Q1, Q2, Q3, Q4, Q5, Q6 and Q7; and (D2): Motivation of students to study with the support of the H5P plugin (Q8, Q9, Q10, Q11, Q12, Q13 and Q14). To ensure the legitimacy and consistency of the responses, similar questions were used, in addition to interspersing positive (e.g., Q1, Q3, Q4, Q6, Q8, Q10, Q11 and Q14), and negative questions (e.g., Q2, Q5, Q7, Q9, Q12 and Q13) (MORAES et al., 2012; WAKITA et al., 2012). The questionnaire was organized with four possible answers, since a "neutral" position of the students was not intended, i.e.: (i) totally disagree; (ii) partially disagree; (iii) partially agree; and (iv) totally agree. The numerical order could be whether descending (4, 3, 2, 1) or ascending (1, 2, 3, 4) depending on the statement being favourable or unfavourable, thus enabling the calculation of mean values, standard deviation, frequency, percentage, and cumulative percentage (BOONE & BOONE, 2012; BEATH, & JONES, 2018). Besides descriptive statistics, other statistical comparisons were performed. Firstly, to measure the internal consistency of the instrument (i.e., reliability), Cronbach's alpha coefficient was applied (BOONE & BOONE, 2012; BEATH, & JONES, 2018). To test whether there is a significant correlation between dimensions D1 and D2, the Canonical correlation analysis was use (HARDOON et al., 2004). In addition, to test whether there is a significant correlation between questions (Q1-Q14), Spearman Rank Order correlation was use (HARDOON et al., 2004). Ultimately, in order to test if there are differences in opinions

between students, regarding the variables: gender; academic majors; grade level; and Brazilian regions they inhabit, three statistical tests were performed, namely: (i) the independent samples t test; (ii) the Fisher's statistic; and (iii) the Tukey's posterior test (CHAMBERS, 2017; BEATH, & JONES, 2018). All statistical analysis was conducted from data processing using Statistical Package for Social Sciences – SPSS software version 18 for Windows.

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Ethics Statement

This study was approved by the Ethics Research Committee of the Metropolitan University of Santos (UNIMES) - opinion n. 5.788.781, and by the system CEP/CONEP - CAAE n. 63995822.7.0000.5509. Participation in the study was voluntary, and participants could withdraw from the survey at any point. The online survey was completely anonymous and does not contain any information allowing identifying the participant.

CRediT author statement

Vinicius Roveri: Conceptualization; Data curation; Formal analysis; Methodology; Writing - original draft. **Simone Caivano**: Data curation; Formal analysis; Methodology; Writing - review & editing. **Luis Borges Gouveia**: Supervision; Writing - review & editing.

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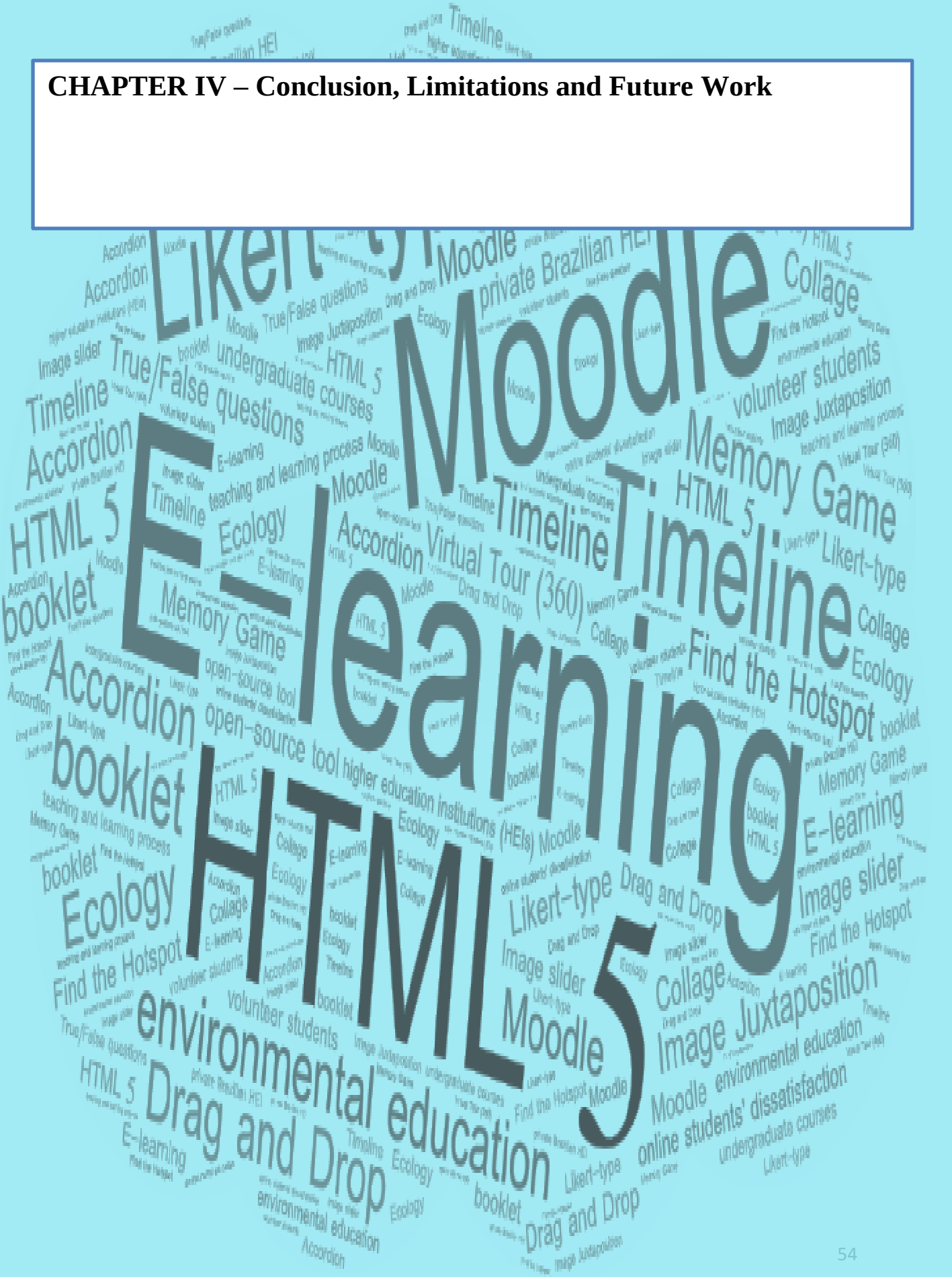
Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CHAPTER IV – Conclusion, Limitations and Future Work



1. Conclusion

According to the results of this research, the following conclusions we reached, summarized below:

1.1 Benefit of H5P to students

- Students' feedback showed that H5P can assist in teaching learners of different backgrounds and motivations, fostering active learning.
- Innovative, pedagogically informed instructional design of the H5P plugin, was instrumental in increasing student engagement and improving learning outcomes in Moodle.
- H5P resources provided students with the opportunity to engage with content in a more personalized manner. Moreover, this personalized learning that actively engages students with the content improved student satisfaction.
- Learning environments that are personalized with H5P provide a space where students are able challenge themselves and go beyond the minimum level of knowledge reproduction, thereby improving learning outcomes.
- Using H5P, students can increase their critical thinking and problem-solving skills and their understanding of the course contents.

1.2 Benefit of H5P to educators, and content creators

- Since H5P does not require a steep learning curve or specialist skills, educators, and content creators can rapidly to prototype and develop creative solutions to pedagogical problems. Therefore, H5P can be used by educators, and content creators worldwide.
- The variety of applications of the H5P allows for educators include of a variety of formative assessments as part of the instructional design of courses.
- H5P Interactive video is an approachable solution for educators who want to transform a passive video viewing into an active learning experience.
- Educators can create asynchronous lessons for students to complete at their own pace.

2. Limitations research and Future Work

The aim of this study was to verify the perception of 395 among 11,000 DL undergraduate students at UNIMES about the use of H5P Moodle interactive content during the teaching and learning process of EE. Only 122 among those 395 students invited (i.e., 107 female and 15 male), agreed to participate. In this way, new studies will be carried out with the aim of analyzing the perception of a larger number of UNIMES students. Moreover, it is important to note that the gender composition of the sample was skewed towards females. In future work, efforts also will be made to recruit a more balanced sample with equal representation of both genders.

2.1 Combining the e-learning and face-to-face teaching

Another feature of H5P is the possibility of combining e-learning and face-to-face teaching. The educational principle of the flipped classroom provides the opportunity to effectively combine e-learning and face-to-face teaching within a single framework. Therefore, the use of H5P Moodle in face-to-face teaching, will provide a major procedural benefit by allowing the easy adjustment of pre-existing material into suitable online content.

ANNEX

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PERCEPTIONS OF DISTANCE UNDERGRADUATE LEARNING STUDENTS TOWARDS USE H5P INTERACTIVE CONTENT DURING THE TEACHING AND LEARNING PROCESS OF THE ENVIRONMENTAL EDUCATION

Vinicius Roveri [1]
Simone Caivano [2]
Luis Borges Gouveia [3]

DOI: 10.5281/zenodo.8887092

Abstract

The aim of this study was to verify the perception of 395 distance learning undergraduate students at a Brazilian private university about the use of H5P Moodle interactive content during the teaching and learning process of environmental education (EE). The hypothesis, in line with previous studies, is that most students would report positive experiences after studying through interactive resources. Based on a quantitative, descriptive, and cross-sectional study, these volunteer students carried out the following contributions to this research: (i) They compared the VLE Moodle traditional didactic resources versus H5P Moodle interactive resources. Specifically, the subject studied was "concepts of Ecology"; (ii) They answered an instrument comprised two analysis dimensions (i.e., Feasibility and Motivation) consisting of 14 assertions of the Likert-type. 122 among those 395 students invited, agreed to participate. The study on the reliability of the instrument resulted in a coefficient equal to 0.80. Therefore, it is possible to state that on another occasion, these students would respond to the instrument in the same way. The number of validated assertions was 11/14 (a loss of the 21.40% of the assertions). However, the loss of up to 40% of the total statements is considered adequate when using the Likert scale. Considering only these 11 validated assertions, the overall main of the instrument was 3.35 points (Standard Deviation = 0.36), which demonstrates a positive student perception of the evaluated object. Ultimately, the tested hypothesis was confirmed, and thus, the most students reported positive experiences after having studied EE through H5P interactive resources.

Keywords: Moodle. Plugin H5P. Technology enhanced learning. Active Learning. Playful learning.

REVISTA CONTRIBUCIONES A LAS CIENCIAS SOCIALES

Statistical dataset on the profile and the perceptions of distance undergraduate learning students towards using H5P interactive content during the teaching and learning process of the sustainability education

Conjunto de dados estatísticos sobre o perfil e as percepções de alunos de graduação a distância sobre o uso de conteúdo interativo H5P durante o processo de ensino e aprendizagem da educação para a sustentabilidade

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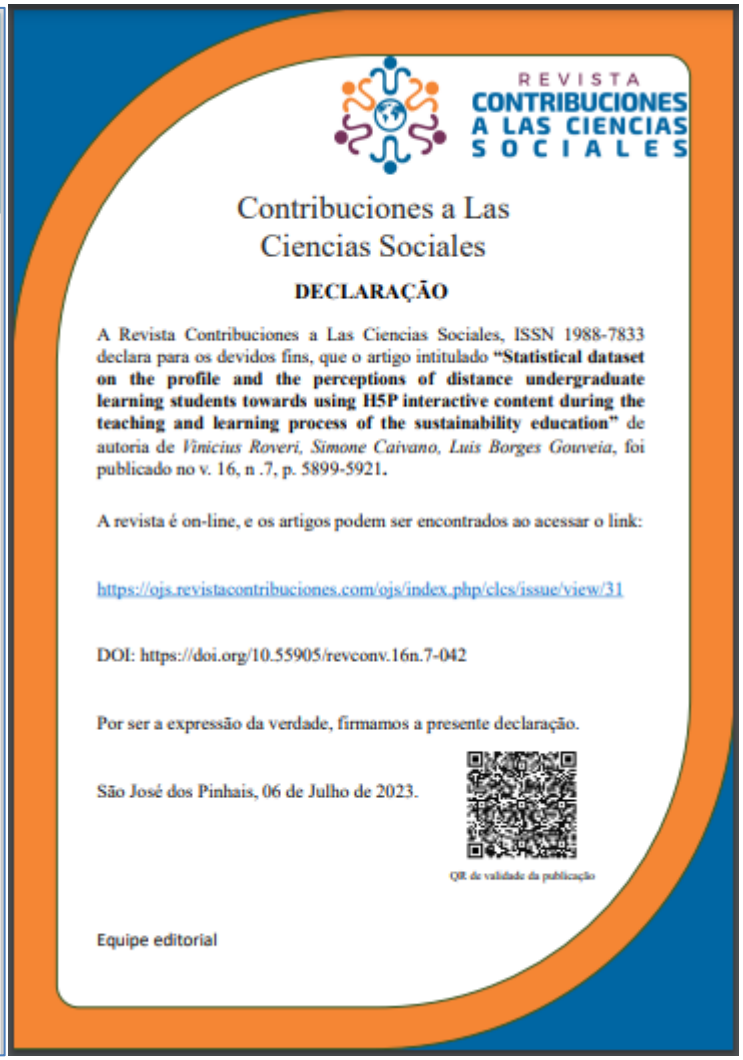
ABSTRACT
This paper presents dataset on profile, besides perception of 122 distance undergraduate learning students from a higher education institutions private Brazilian about the use of H5P Moodle



REVISTA CONTRIBUCIONES A LAS CIENCIAS SOCIALES

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DECLARAÇÃO

A Revista Contribuciones a Las Ciencias Sociales, ISSN 1988-7833 declara para os devidos fins, que o artigo intitulado **"Statistical dataset on the profile and the perceptions of distance undergraduate learning students towards using H5P interactive content during the teaching and learning process of the sustainability education"** de autoria de *Vinicius Roveri, Simone Caivano, Luis Borges Gouveia*, foi publicado no v. 16, n .7, p. 5899-5921.

A revista é on-line, e os artigos podem ser encontrados ao acessar o link:

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Por ser a expressão da verdade, firmamos a presente declaração.

São José dos Pinhais, 06 de Julho de 2023.

QR de validade da publicação

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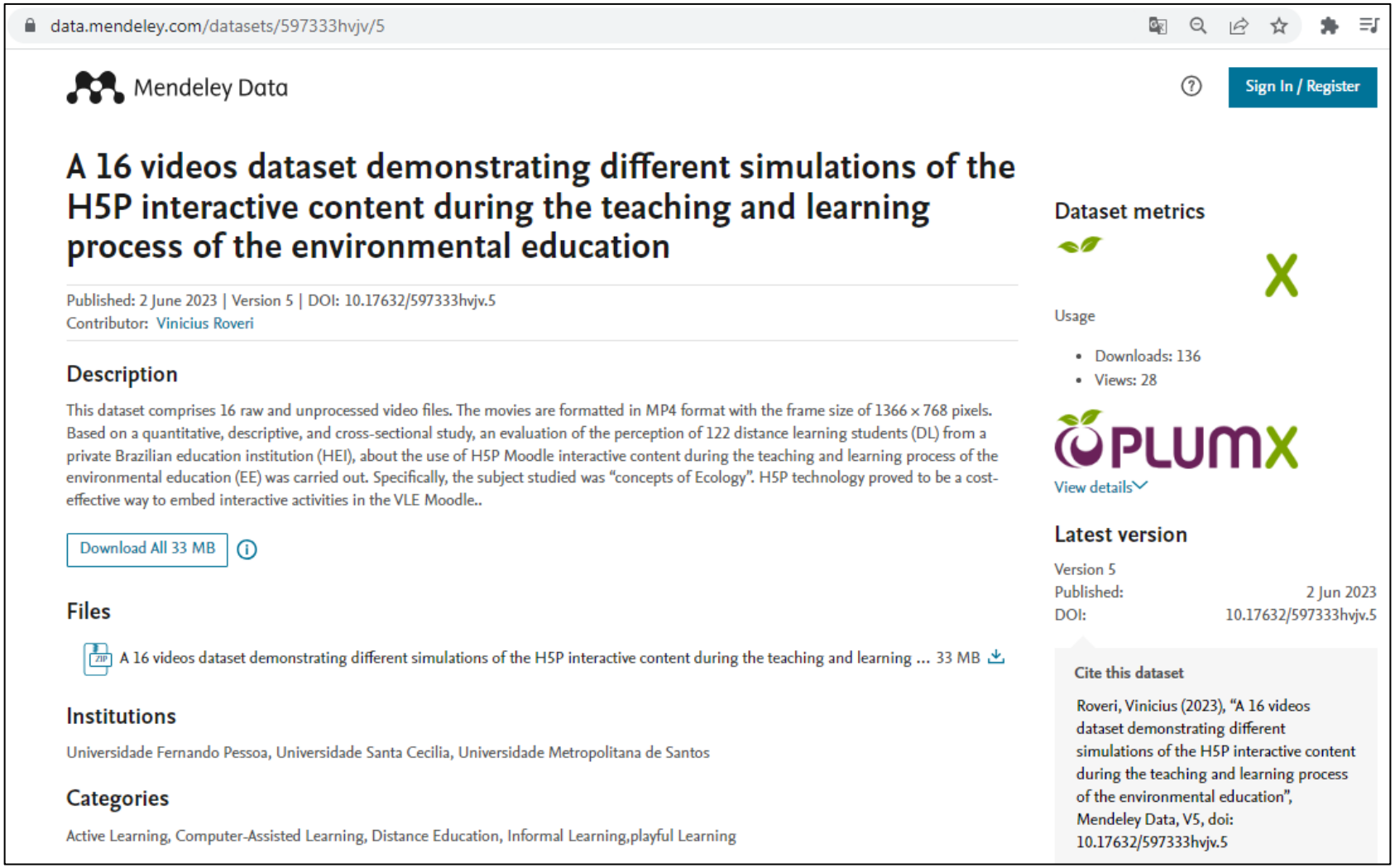
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A 16 videos dataset demonstrating different simulations of the H5P interactive content during the teaching and learning process of the environmental education
Published: 2 June 2023 | Version 5 | DOI: 10.17632/597333hvjv.5
Contributor: Vinicius Roveri
Description
This dataset comprises 16 raw and unprocessed video files. The movies are formatted in MP4 format with the frame size of 1366 x 768 pixels. Based on a quantitative, descriptive, and cross-sectional study, an evaluation of the perception of 122 distance learning students (DL) from a private Brazilian education institution (HEI), about the use of H5P Moodle interactive content during the teaching and learning process of the environmental education (EE) was carried out. Specifically, the subject studied was "concepts of Ecology". H5P technology proved to be a cost-effective way to embed interactive activities in the VLE Moodle..
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Dataset metrics
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Downloads: 136
Views: 28
PLUMX
View details
Latest version
Version 5
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DOI: 10.17632/597333hvjv.5
Cite this dataset
Roveri, Vinicius (2023), "A 16 videos dataset demonstrating different simulations of the H5P interactive content during the teaching and learning process of the environmental education", Mendeley Data, V5, doi: 10.17632/597333hvjv.5

PERCEPÇÕES DE ESTUDANTES DE GRADUAÇÃO A DISTÂNCIA SOBRE O USO DE CONTEÚDOS INTERATIVOS H5P DURANTE O PROCESSO DE ENSINO E APRENDIZAGEM

VINICIUS ROVERI; SIMONE CAIVANO; LUIS BORGES GOUVEIA

III CONGRESSO BRASILEIRO DE EDUCAÇÃO A DISTÂNCIA ON-LINE 2023

INTRODUÇÃO

Embora estudos mostrem que a Educação a Distância (EAD) tem crescido consideravelmente entre as instituições de ensino superior (IES) mundiais, a insatisfação dos alunos online parece aumentar na mesma proporção. Por exemplo, estudos têm mostrado que a falta de recursos de interatividade de ambientes virtuais de aprendizagem (AVA) (como o *Moodle*), ainda é uma das principais insatisfações desses alunos (Manacek et al., 2020). Uma ferramenta que permite aumentar os recursos de interatividade do *Moodle* é o *plugin* H5P. Considerada uma ferramenta de código aberto versátil, o H5P permite que os educadores criem mais de 40 objetos de aprendizagem interativos.

OBJETIVO

O objetivo deste estudo foi verificar a percepção de 395 alunos de graduação EAD de uma IES privada brasileira sobre o uso do conteúdo interativo H5P *Moodle* durante o processo de ensino e aprendizagem da educação ambiental (EA).

METODOLOGIA

Aspectos Éticos: Este estudo foi aprovado pelo Comitê de Ética em Pesquisa da Universidade Metropolitana de Santos (UNIMES) - parecer n. 5.788.781, e pelo sistema CEP/CONEP - CAAE n. 63995822.7.0000.5509.

Características do Estudo: A partir de um estudo quantitativo, descritivo e transversal, esses alunos realizaram as seguintes contribuições para esta pesquisa (CAIVANO and DOMENE, 2020):
(i) Eles compararam os recursos didáticos tradicionais do AVA *Moodle* versus os recursos interativos do H5P *Moodle*. Especificamente, o tema estudado foi **"Ecologia".** Assista estes vídeos em ROVERI (2023).
(ii) Eles responderam a um instrumento composto por duas dimensões de análise (ou seja, Viabilidade e Motivação em estudar com recursos *Moodle*/H5P) composto por 14 assertivas do tipo Likert. Ambas as etapas da pesquisa foram acessadas por meio do *Moodle* da UNIMES e foram realizadas 02 de dezembro de 2022 a 02 de fevereiro de 2023. Não houve critérios de exclusão, além disso, cada aluno foi autorizado a responder o questionário uma vez.
Instrumento de Análise: O questionário foi organizado com quatro possibilidades de resposta, ou seja: (i) discordo totalmente; (ii) discordo parcialmente; (iii) concordo parcialmente; e (iv) concordo totalmente. O valor médio foi utilizado para a verificação do comportamento dos dados e sua dispersão com base nas seguintes definições: (i) De 1,00 a 1,99 pontos: Má percepção do objeto avaliado; (ii) De 2,00 a 2,99 pontos: Percepção globalmente positiva; (iii) De 3,00 a 4,00 pontos: Percepção positiva do objeto avaliado; e (iv) Desvio Padrão aceitável (DP): <1,5 pontos.
Confiabilidade do instrumento: foi aplicado o coeficiente de *Spearman-Brown* com critério de aceitação r > 0,80. Toda análise estatística foi realizada com *o software* SPSS versão 18 para *Windows*.

RESULTADOS E DISCUSSÃO

Perfil dos participantes: Dos 395 alunos selecionados, 122 aceitaram participar, sendo 107 mulheres e 15 homens.
Perfil dos cursos: A maioria dos alunos participantes era do curso de Pedagogia (81 alunos), seguido do curso de Gestão Pública (18 alunos).
Estudo da confiabilidade do instrumento: resultou em um coeficiente igual a 0,80. Portanto, é possível afirmar que em outra ocasião, esses alunos responderiam ao instrumento da mesma forma.
Número de assertivas validadas: foram 11/14 (perda de 21,40% das assertivas). No entanto, a perda de até 40% do total de afirmações é considerada adequada quando se utiliza a escala Likert.
Média geral do instrumento: foi de 3,35 pontos (DP = 0,36), o que demonstra uma percepção positiva do aluno sobre o objeto avaliado.
Análise da percepção dos alunos: Em linha com estudos anteriores, a maioria dos alunos relatou experiências positivas e motivadoras após terem estudado EA através dos recursos interativos do H5P.

CONCLUSÃO

A tecnologia H5P provou ser uma maneira econômica de incorporar atividades interativas no *Moodle*. Como existem mais de 290 milhões de usuários do *Moodle* em todo o mundo, o uso desse *plug-in* em IES públicas e privadas pode encorajar educadores e/ou *designers* instrucionais de todo o mundo, a criarem uma variedade de objetos de aprendizagem interativos baseados no H5P *Moodle*. Além disso, a tecnologia H5P *Moodle* mostrou-se um método eficiente para o processo de ensino e aprendizagem do tema transversal EA (Ecologia).

REFERÊNCIAS

1) CAIVANO, Simone dos Anjos; DOMENE, Semíramis Martins Álvares. Consensus among experts on healthy eating and diet quality index. Ciência & Saúde Coletiva, v. 25, p. 2551-2560, 2020.
2) MANACEK, Sarah et al. H5P interactive video: An opportunity to personalize learning. In: SITE Interactive Conference. Association for the Advancement of Computing in Education (AACE), 2020. p. 520-526.
3) ROVERI, Vinicius, "A 16 videos dataset demonstrating different simulations of the H5P interactive content during the teaching and learning process of the environmental education", Mendeley Data, V2, 2023. doi: 10.17632/597333hvjv.2


III CONGRESSO BRASILEIRO DE
EDUCAÇÃO A DISTÂNCIA
ON-LINE 2023
CERTIFICADO
Certificamos para os devidos fins que o trabalho intitulado "PERCEPÇÕES DE ESTUDANTES DE GRADUAÇÃO A DISTÂNCIA SOBRE O USO DE CONTEÚDOS INTERATIVOS H5P DURANTE O PROCESSO DE ENSINO E APRENDIZAGEM" de autoria de VINICIUS ROVERI, SIMONE CAIVANO E LUIS BORGES GOUVEIA foi apresentado na modalidade "BANNER DIGITAL" durante o III Congresso Brasileiro de Educação a Distância On-line exibido no período de 26 a 29 de junho de 2023.
Fortaleza/CE, 29 de junho de 2023.
Prof. Dr. Vandbergue Santos Pereira
Coordenador do evento
Instituto Multiprofissional de Ensino - IME
CNPJ: 36.773.074/0001-08
Organização
Parceiro
Patrocinador
Instituto
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CERTIFICADO
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Fortaleza/CE, 24 de julho de 2023.
Prof. Dr. Vaudbergue Santos Pereira
Coordenador do evento
Instituto Multiprofissional de Ensino - IME
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UNIVERSIDADE
METROPOLITANA DE SANTOS
- UNIMES

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Percepção de estudantes de graduação a distância sobre o uso de conteúdos interativos durante o processo de ensino e aprendizagem

Pesquisador: Vinicius Roveri

Área Temática:

Versão: 2

CAAE: 63995822.7.0000.5509

Instituição Proponente: CENTRO DE ESTUDOS UNIFICADOS BANDEIRANTE

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 5.788.781

Apresentação do Projeto:

As informações elencadas nos campos "Apresentação do Projeto" foram retiradas do arquivo Informações Básicas da Pesquisa (PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_2020755.pdf de 28/10/2022): "A educação a distância (EAD) pode ser entendida como um processo de ensino-aprendizagem cuja característica principal se dá pela separação física e espacial entre professores e estudantes e, também, pela presença de um Ambiente Virtual de Aprendizagem (AVA), como por exemplo, o AVA-Moodle (do inglês, Modular Object Oriented Dynamic Learning Environment), de modo a possibilitar a interação entre eles. No entanto, estudos têm mostrado que, embora o Moodle seja o AVA mais utilizado mundialmente, a sua infraestrutura ainda carece de uma efetiva interatividade, constituindo-se, portanto, um dos principais desafios da EAD na atualidade. Neste sentido, houve nos últimos anos, o desenvolvimento de novas Tecnologias de Informação e Comunicação (TIC) que, ao se integrarem ao AVA-Moodle, passaram a proporcionar uma efetiva interatividade durante processo de ensino e aprendizagem na EAD. Dentre as TIC, há o plugin H5P (uma abreviação de HTML 5 Package), um pacote de aplicações de código aberto que permite o emprego de mais de 30 recursos interativos, como por exemplo, vídeos, slides, questões avaliativas, além de diversas atividades gameficadas que permitem aplicar elementos de jogos no AVA-Moodle. No entanto, apesar da ampla possibilidade de aplicação do H5P na área da educação, ainda há uma lacuna de informação a ser resolvida: Qual a percepção dos estudantes da EAD sobre o uso do H5P

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como um recurso de interatividade?".

Objetivo da Pesquisa:

As informações elencadas nos campos "Objetivo da Pesquisa" foram retiradas do arquivo Informações Básicas da Pesquisa (PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_2020755.pdf de 28/10/2022): "verificar a percepção de estudantes de graduação EAD sobre o uso de conteúdos interativos H5P durante o processo de ensino e aprendizagem".

Avaliação dos Riscos e Benefícios:

As informações elencadas nos campos "Avaliação de riscos e benefícios" foram retiradas do arquivo Informações Básicas da Pesquisa (PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_2020755.pdf de 28/10/2022): "Riscos: A participação nesta pesquisa pode ter como principal risco e/ou desconforto, o cansaço e/ou aborrecimento em realizar algumas simulações dos recursos interativos H5P no AVA da Universidade Metropolitana de Santos (UNIMES), além também, de responder questionários.

Benefícios:

Conhecer a percepção dos estudantes sobre a viabilidade do uso de conteúdos interativos H5P para a promoção do processo de ensino-aprendizagem no EAD da Universidade Metropolitana de Santos, além também, de verificar a motivação destes estudantes para estudar com oapoio deste plugin".

Comentários e Considerações sobre a Pesquisa:

Projeto bem estruturado, exequível de caráter acadêmico.

Considerações sobre os Termos de apresentação obrigatória:

Apresenta os Termos obrigatórios para a realização da pesquisa, conforme com as Resoluções do CNS n.466/12 e 510/16.

Conclusões ou Pendências e Lista de Inadequações:

As pendências do parecer anterior foram sanadas.

O projeto está de acordo com as Resoluções do CNS 466/12 e 510/16.

Projeto aprovado.

Considerações Finais a critério do CEP:

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Continuação do Parecer: 5.788.781

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_2020755.pdf	28/10/2022 11:18:16		Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE.pdf	28/10/2022 11:17:43	Vinicius Roveri	Aceito
Projeto Detalhado / Brochura Investigador	VR2.pdf	05/10/2022 09:19:05	Vinicius Roveri	Aceito
Folha de Rosto	VR.pdf	05/10/2022 09:12:11	Vinicius Roveri	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

SANTOS, 01 de Dezembro de 2022

Assinado por:
Marcela Leticia Leal Gonçalves
(Coordenador(a))

ONOMASTIC INDEX

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- ✓ Laboratório de Pesquisa em Produtos Naturais, Universidade Santa Cecília, Rua Cesário Mota 8, F83A, 11045-040 Santos, São Paulo, Brasil
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