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PERFORMANCE OF DISTANCE LEARNING HIGHER EDUCATION COURSES COMPARED TO FACE-TO-FACE AND THE CONTRIBUTIONS OF ARTIFICIAL INTELLIGENCE

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ABSTRACT

The exponential growth in enrollments in distance learning technology courses aroused the interest of verifying whether there was a difference between the performance of students who graduated from distance learning courses and that of students who studied entirely in person. In view of this, the present study sought to compare the performance of graduates of distance learning higher education courses: human resources management, financial management, logistics and marketing, with the performance of these same courses, in the face-to-face modality, based on the Enade scores of 2018 and 2022, the Enade Concept, the General Course Index and the Preliminary Course Concept of a private Higher Education Institution. The qualiquanti approach was adopted, supported by the descriptive and exploratory methods, combined with a case study of an Institution that stopped offering face-to-face technological courses and started to offer them only in distance education. It was concluded that distance courses presented a lower performance in relation to face-to-face courses, and it is necessary for the Institution to adopt quick measures aimed at identifying the reasons that led to this drop in the quality of its courses and promoting actions aimed at improving the performance of the courses and, for this, it could use AI systems.

Keywords: Performance of Higher Education Courses. Distance Learning. Higher Technology Courses. Artificial intelligence. Quality of Higher Education Courses.

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INTRODUCTION

The regulation of the distance learning modality was recognized for all levels of education in 2005, mainly affecting higher education.

The first National Education Plan (PNE) of 1998 already provided for the use of Distance Education (DE) to expand the offer of higher education courses, but it was with the growth of Higher Education Institutions (HEIs) in the private sector (from 1004 in 2000 to 2574 institutions in 2021) after the publication of the second PNE in 2014, that there was an exponential offer of vacancies for courses in this modality. Of this sharp growth, the biggest increase occurred in Higher Technology Courses (CST), which grew approximately 2500% between 2001 and 2022, with emphasis on courses in the "management and business" and "information and communication" axes (Brasil, 2022), which culminated in the expansion of distance education centers in Brazil, which went from 15,452 in 2018 to 46,687 in 2023, pointing to a growth of 302% in the period (Semesp, 2023).

The year 2017 became a milestone, with the publication of Federal Decree No. 9,057, which allowed HEIs to offer courses exclusively at a distance, with accreditation of distance education courses unlinked to the prior accreditation of face-to-face courses (Mattos; Silva, 2020).

In the Covid-19 pandemic, HEIs were compelled to adapt their face-to-face courses to emergency remote teaching. In private HEIs, this change in the management system resulted in the expansion of distance education courses and in some institutions, in the closure of face-to-face courses, promoting an internal restructuring, starting to offer courses almost exclusively at a distance.

This scenario has mobilized efforts to evaluate the quality of the training of students in distance education courses, as it is questioned whether distance courses have the power to develop the same skills in trained professionals that face-to-face courses develop. In this sense, a way to measure the performance of graduates of higher education courses is sought, which makes it possible to draw a comparison between classes of students who studied in person and those who studied in the distance learning modality, to assess whether the course modality influences the development of competencies.

Currently, the evaluation of higher education courses has been done through tools adopted by the National System of Higher Education (Sinaes). This system not only evaluates the courses, but also the Institutions that offer and use them for the evaluation process, indicators such as the General Course Index (IGC), the Preliminary Course

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Concept (CPC), the score of the National Student Performance Exam (Enade) and the Enade Concept. However, in addition to the grades obtained by Sinaes, other aspects can be considered in the evaluation of the quality of the courses offered, such as the teaching-learning processes and the Institution's ability to retain students, reducing dropout rates.

To manage the management and teaching-learning processes, with the objective of optimizing the quality of the courses offered, Educational Institutions have adopted technology systems based on Artificial Intelligence, which has demonstrated its effectiveness as a management tool and support for teachers and students in the construction of knowledge and development of socio-professional skills.

In view of the context presented, the following question arises: how can Artificial Intelligence be used to monitor, evaluate and optimize the management and teaching-learning processes of Higher Education Institutions, aiming to increase the performance of graduates of distance learning higher education courses?

The general objective was to compare the performance of graduates of higher education courses in distance technology: human resources management, financial management, logistics and marketing, with the performance of these same courses, in the face-to-face modality, based on the Enade scores of 2018 and 2022, the Enade Concept, the IGC and the CPC of a private HEI.

As for the specific objectives, the following were set:

1. Characterize the evolution of enrollments in higher technology courses, by dependency, teaching modality and training axis;
2. Identify which are the instruments that integrate the evaluations in order to measure the performance of graduates of higher education courses in distance technology;
3. To analyze the relationship between admission to higher education courses in distance technology and its conclusion, discussing the issue of dropout in this modality of education, under the aspect of course evaluation;
4. Indicate the use of Artificial Intelligence in Educational Institutions, aimed at improving management and teaching-learning processes.

DISTANCE LEARNING TECHNOLOGY COURSES IN BRAZIL: GROWTH AND CHALLENGES TO ENSURE QUALITY

Until 2002 there were no fully distance learning higher education courses in Brazil. The first courses in this modality appeared in 2003 (Brasil, 2022), but their operation was

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linked to the face-to-face course accredited by the Ministry of Education - MEC (Silva; Castro, 2022).

In 2014, the National Education Plan (PNE) was published, where one of the goals referred to the increase of the gross enrollment rate in Higher Education to 50% and the net rate to 33% of the population aged 18 to 24 years.

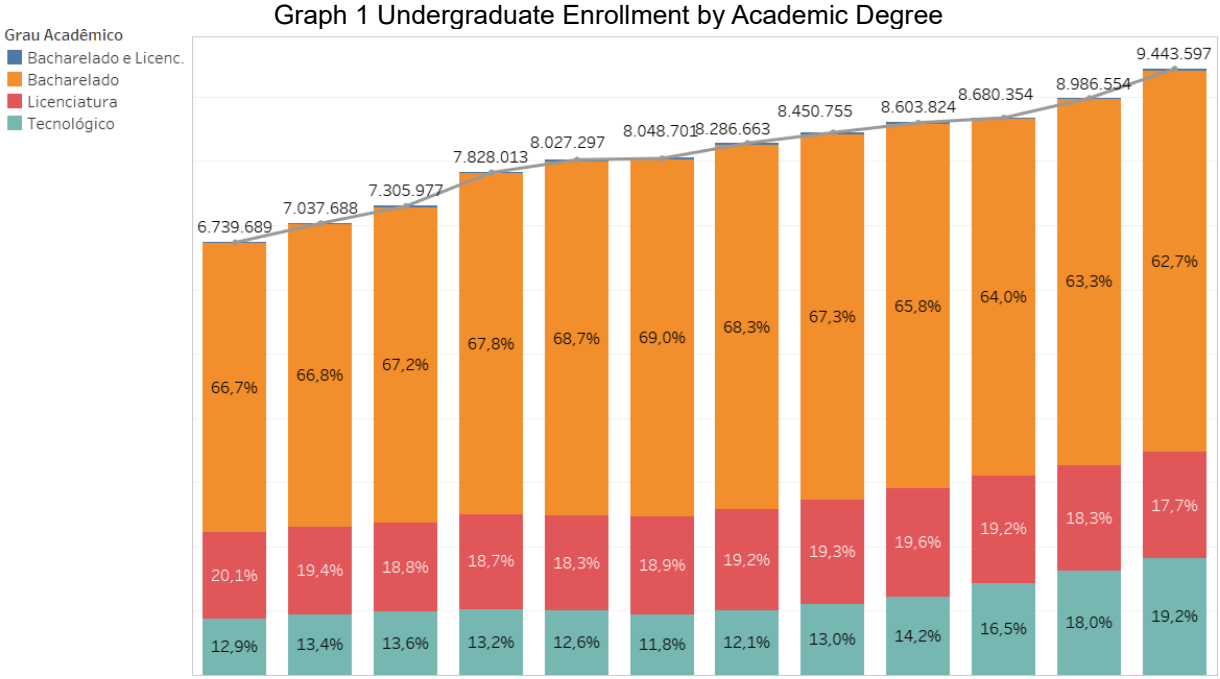
According to data collected in the Higher Education Censuses, published by the National Institute of Studies and Research (Inep), it is observed that enrollment in higher education in Brazil has grown at an annual rate of around 3.1%, starting in 2011.

According to the Brazilian Institute of Geography and Statistics (IBGE), from 2010 to 2022, the annual growth rate of the country's population was 0.52%.

On the other hand, the growth was not similar in the three academic degrees, bachelor's degrees, licentiate degrees, and technological courses. The annual enrollment rate corresponded to 2.9%, 1.9%, and 7.1% for academic degrees, respectively.

From 2011 to 2014, there was a moderate growth in enrollment in CST, with a subsequent reduction until 2016. From 2017 onwards, a sharp growth in the number of enrollments began, at an annual rate of more than 10% (Graph 1).

Graph 1 Undergraduate Enrollment by Academic Degree



Grau Acadêmico	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Bacharelado e Licenc.	16.995	22.532	23.747	22.286	29.074	32.242	35.583	34.678	29.667	21.789	27.907	38.004
Bacharelado	4.495.831	4.703.693	4.912.310	5.309.412	5.516.151	5.549.736	5.662.351	5.689.335	5.662.939	5.559.687	5.691.473	5.922.108
Licenciatura	1.356.329	1.366.559	1.374.174	1.466.548	1.471.930	1.520.494	1.589.440	1.628.676	1.687.367	1.663.681	1.648.328	1.669.911
Tecnológico	870.534	944.904	995.746	1.029.767	1.010.142	946.229	999.289	1.098.066	1.223.851	1.435.197	1.618.846	1.813.574
Total geral	6.739.689	7.037.688	7.305.977	7.828.013	8.027.297	8.048.701	8.286.663	8.450.755	8.603.824	8.680.354	8.986.554	9.443.597

Source: Prepared by the authors, based on data from the 2022 Higher Education Census (Brasil, 2023).

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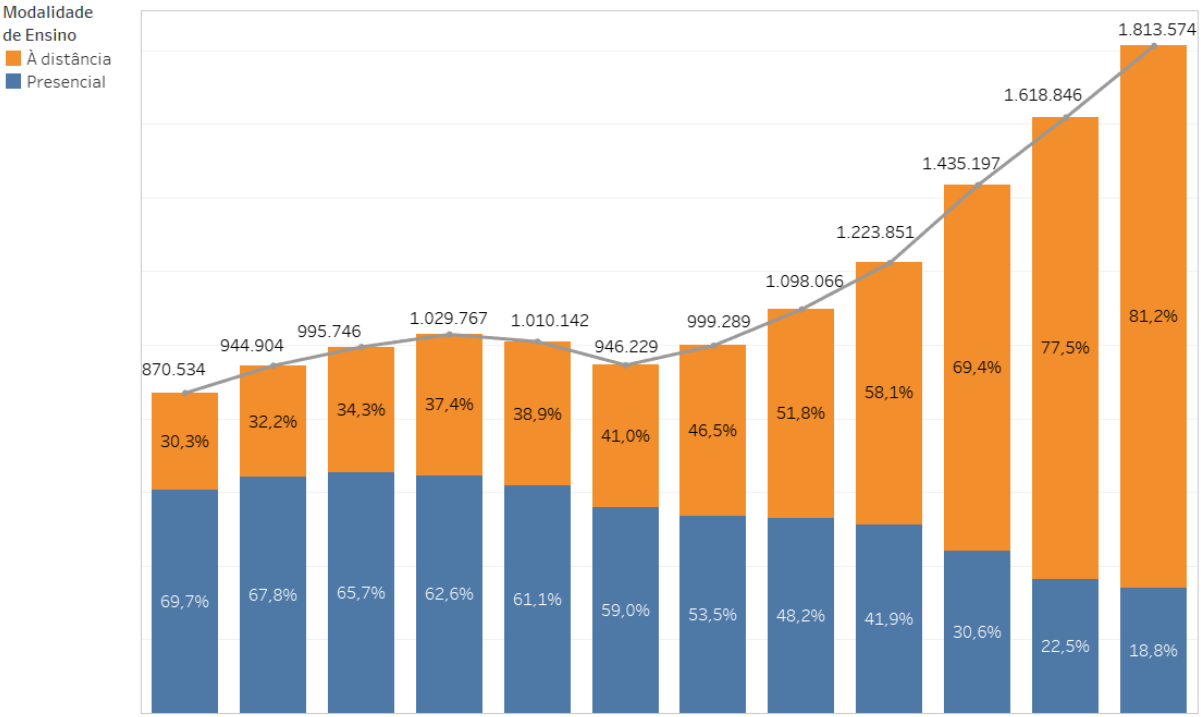
The growth in total enrollments of CST in the period occurred mainly in the distance learning modality, at a rate of 17.4%, while enrollments in the face-to-face education modality showed a negative growth of -4.9% (Graph 2).

Graph 2 Enrollments in CST by Teaching Modality



Modalidade de Ensino	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
À distância	263.970	304.221	341.177	384.642	392.674	388.301	464.354	568.873	710.827	995.363	1.255.086	1.472.810
Presencial	606.564	640.683	654.569	645.125	617.468	557.928	534.935	529.193	513.024	439.834	363.760	340.764
Total geral	870.534	944.904	995.746	1.029.767	1.010.142	946.229	999.289	1.098.066	1.223.851	1.435.197	1.618.846	1.813.574

Source: Prepared by the authors, based on data from the 2022 Higher Education Census (Brasil, 2023).

The growth in enrollments in the distance modality occurred primarily in private institutions, while enrollments in the face-to-face modality in these institutions decreased.

In public institutions, face-to-face enrollments in CST maintained a slight growth with an average annual rate of 2.8%. Enrollments in the distance modality fluctuated positively and negatively, remaining around 10% of the total enrollments in these institutions (Graph 3).

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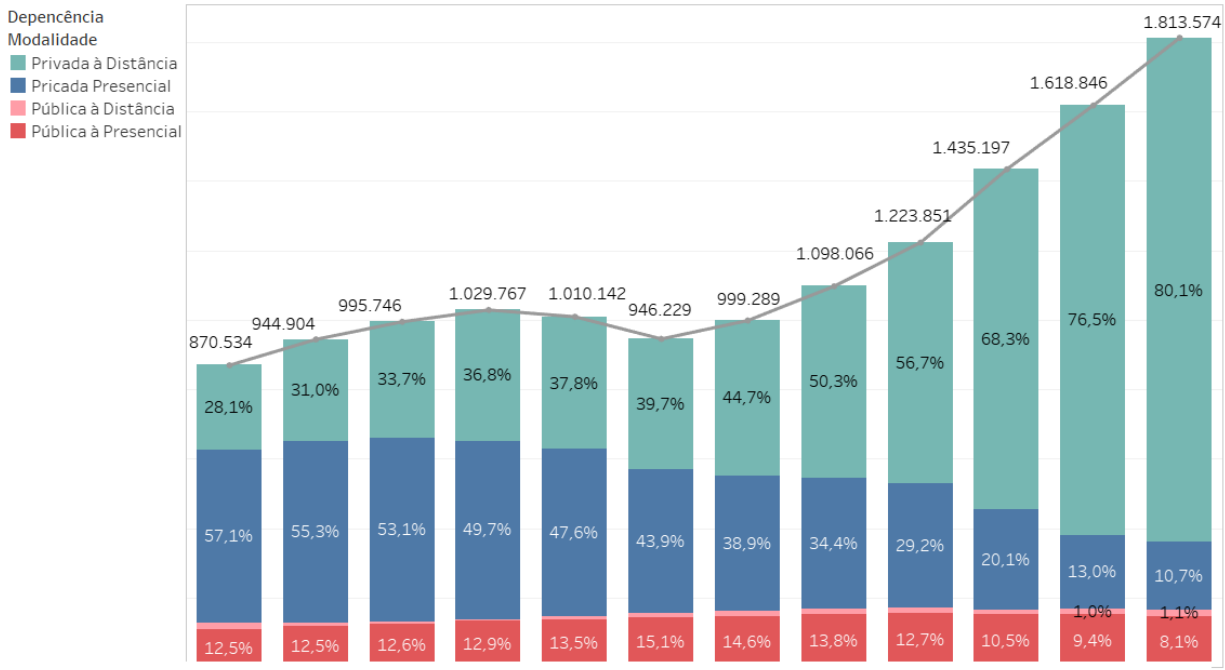
Graph 3 Enrollments in CST by Dependency and Modality of Education



Depencência Modalidade	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Privada à Distância	244.522	293.172	335.354	379.095	381.660	375.627	447.063	552.395	693.633	980.462	1.238.663	1.453.466
Pricada Presencial	497.479	522.823	529.214	512.255	481.245	415.458	388.758	377.658	357.668	288.583	210.942	194.674
Pública à Distância	19.448	11.049	5.823	5.547	11.014	12.674	17.291	16.478	17.194	14.901	16.423	19.344
Pública à Presencial	109.085	117.860	125.355	132.870	136.223	142.470	146.177	151.535	155.356	151.251	152.818	146.090
Total geral	870.534	944.904	995.746	1.029.767	1.010.142	946.229	999.289	1.098.066	1.223.851	1.435.197	1.618.846	1.813.574

Source: Prepared by the authors, based on data from the 2022 Higher Education Census (Brasil, 2023).

Consequently, according to the data, it was found that the expansion of CST is a phenomenon that occurred in private institutions and in particular in the distance modality, and in 2022, 81.1% of enrollments in CST corresponded to the distance modality and linked to private institutions.

Segmenting enrollment data by technological axes, it can be seen that the Security, Educational Development, Management and Business, Environment and Health, and Information and Communication axes presented the highest percentage of distance enrollments. However, the Management and Business axis corresponded to the largest number of enrollments, and consequently, to the largest number of distance enrollments, 699 thousand. On the other hand, there are the technological axes of Food Production, Infrastructure and Industrial Production, with more than 60% of enrollments in the face-to-face modality (Graph 4).

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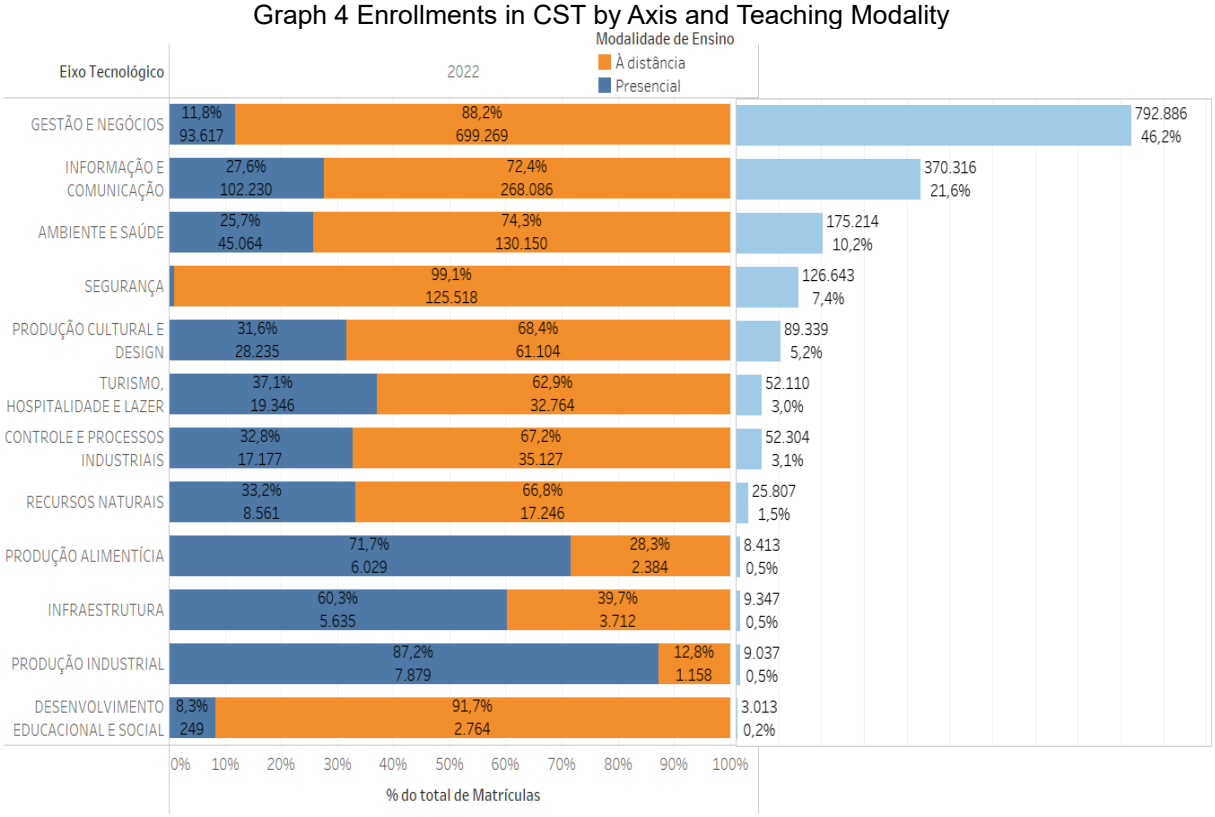
Graph 4 Enrollments in CST by Axis and Teaching Modality



Source: Prepared by the authors, based on data from the 2022 Higher Education Census (Brasil, 2023).

In the period analyzed, the distance learning course of Systems Analysis and Development corresponded to the largest offer, having obtained 174 thousand enrollments. The next 7 courses with the highest number of enrollments in the distance modality corresponded to the Management and Business axis, with emphasis on the Human Resources Management course with 132 thousand enrollments (Graph 5).

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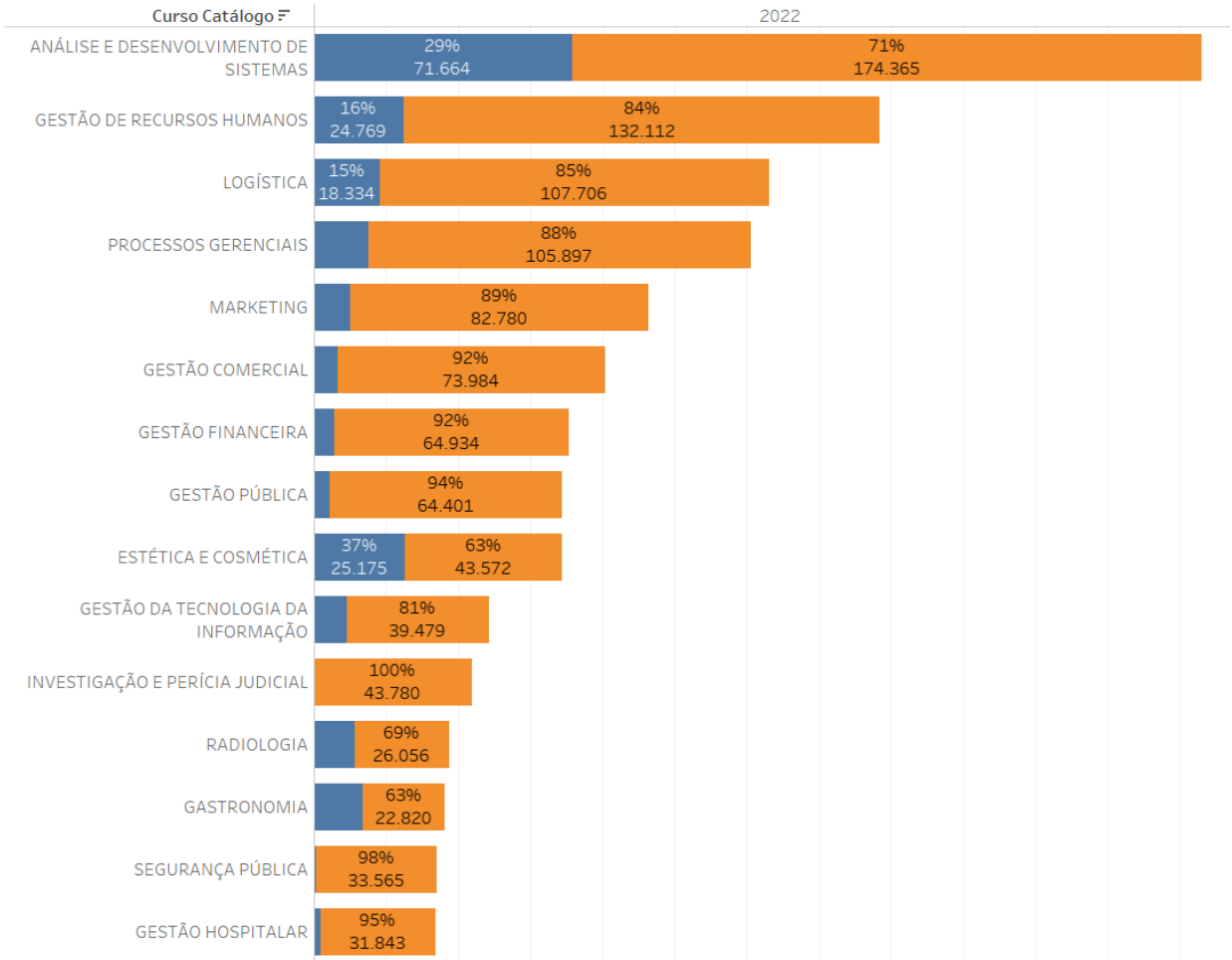
Graph 5 Enrollments by Course and Teaching Modality



Source: Prepared by the authors, based on data from the 2022 Higher Education Census (Brasil, 2023).

Based on information from Inep's Higher Education Census (2023), it was found that the highest growth in enrollments occurred in higher technology courses, "information and communication" and "management and business" axes, in the distance modality, in private Higher Education Institutions.

PERFORMANCE OF GRADUATES: EVALUATION STRATEGIES

According to Nunes, Albernaz and Nobre (2009), in distance education, with the autonomy in the student's learning, institutions need to offer good conditions for quality teaching-learning to be carried out, if this does not happen, dropout becomes more frequent. Thus, according to the authors, for the evaluation of distance education courses, in order to achieve adequate quality, it is necessary to involve techniques, tools, support materials and actors throughout the evaluation process. The study suggests a proposal to evaluate, based on quality models of *software* already developed, emphasizing, however,

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that it is not limited to the quantitative context only, seeking qualitative contribution as well, in evaluation models recognized by the current legislation.

The authors, who investigated the courses of the Federal Institution of Espírito Santo, highlight that the focus would be on an evaluation of distance education courses that would point out indices that would guarantee the "solid and quality training" expected by face-to-face courses. The investigation pointed the way to models based on the quality of *Software* applied in countries such as the United Kingdom, India and China, but also in a general model developed by Rodrigues (1998) that involves the axes: "Adequacy to students, Adequacy of the media, Pedagogical strategy, Planning, Materials, Implementation of the course, Evaluation and Institution" (Rodrigues, 2008 *apud* Nunes; Albernaz; Nobre, 2009).

There are also the positions of Bergamini and Beraldo (1988), which corroborate the fact that performance evaluation was initially developed in companies, emphasizing the important factor, related to subjective issues contemplated by the evaluation process, since it is directly related to individual perception.

The systematic review by Gomes *et al.* (2020) points out the need for this look at the study of performance evaluations of distance education courses, relating the score obtained in the evaluation with what was actually learned and identifying the impact of this learning on professional practice in the long term. The authors state that performance evaluation is a management instrument for identifying, within the course, the measurement of learning, performance of required skills, engagement and even the evaluation of the social impact of training. They also consider that organizations already recognize performance measurement and management as essential for comparing the current level of performance they want to achieve. The authors highlight studies that point out that behavioral characteristics are important data in the construction of learning and student satisfaction, in addition to the impact on performance varying due to the difference between gender and age, and that the participation of students in discussion forums is considered a critical factor, in the view of teachers and managers of distance education courses (Gomes *et al.*, 2020).

The evaluation has undergone important changes. According to Ribeiro and Guerra (2019),

> in the 1990s, the quality of undergraduate courses in Brazil was correlated with national exams to verify the performance of graduate students, according to each area of training; in the 2000s, the concept of evaluation began to be expanded and

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> aspects such as infrastructure, faculty and didactic-pedagogical organization began to be considered (Ribeiro; Guerra, 2019, p. 6).

Since 2004, the evaluation of the performance of higher education courses in Brazil has been carried out through Sinaes (National System of Higher Education), which is a public policy instituted by Law 10.861/2004. The objective of Sinaes is not only to evaluate the courses, but also encompasses the evaluation of other aspects of the HEIs, in order to verify whether the Institutions are offering quality courses, with a good organizational structure, support material, library (physical and digital), collections and qualified faculty.

In article 5 of the Sinaes law , there is a provision for the National Student Performance Exam (Enade), to determine the performance of students graduating from higher education courses. Enade is composed of questions about the syllabus defined in the curricular guidelines of the courses and general training questions (Ribeiro; Guerra, 2019).

Enade and the questionnaires applied to students generate the General Course Index - IGC (grade from 0 to 5) and the Enade Concept, which is examined by the evaluation axes. The axes to comply are five: Institutional Planning and Evaluation (weight 10), Academic Policies (weight 10), Management Policies (weight 20), Institutional Development (weight 30) and Infrastructure (weight 30). The Institutions' Own Evaluation Committees (CPA) adopt annual questionnaires that are sent to the MEC platform (Dias Sobrinho, 2010).

The Enade Concept is calculated for each course, according to the methodology established in the Technical Notes and allows standardization and rescheduling to obtain values from 0 (zero) to 5 (five) (Passos *et al.*, 2023).

Another indicator used in the evaluation process is the Preliminary Course Concept (CPC). This index includes the grades of graduates,

> the values added in the training process, measured by the difference between observed and expected performance, expressed by the indicator of Difference between Observed and Expected Performance (IDD), information on the degree and work regime of the professors of the evaluated courses and the perception of students about the training process, surveyed by means of a questionnaire (Passos *et al.*, 2023, p. 3).

Dias Sobrinho (2010) criticizes the change in the original proposal of Sinaes, which was contrary to the practices of rankings. The author specifies that throughout the implementation of Sinaes, Enade has assumed increasing prominence and autonomy and

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has been consolidated by the media and society in general as a synonym for evaluation. The author also points out that the Own Evaluation Commissions (CPA) have played a little relevant role, in practice, implying a lack of participation of teachers and employees. With the emphasis of Enade, the student became the protagonist of the evaluation, the author points out that:

> the quality of a course and, by extension, of an institution is largely dependent on the student's performance in a test and his opinion about a few items, not considering the specificities of each area, differences related to previous intellectual capital and individual commitments and interests (Dias Sobrinho, 2010, p. 216).

The consequence of this protagonism of an instrument, also according to Dias Sobrinho (2010), impacts the strength of the system that was attributed to Sinaes, in his conception, causing the institutional evaluation to adopt a bureaucratic control only, in search of a good position on the classification scale, not prioritizing the teaching-learning process.

SCHOOL DROPOUT: CHALLENGES TO BE OVERCOME BY HEIS

As challenges of distance learning, Basso *et al.* (2023) consider the infrastructure (systems, computers, type of connection, programs, physical structure) and the ability to interact, both of the student and the teacher, as points that influence the proper functioning of distance courses.

Nunes, Albernaz and Nobre (2009) argue that the student is a protagonist in the teaching-learning process in distance education, but it is up to the institution and other actors to provide adequate means for learning to happen with quality, because even with the advances in technology and distance education. There is an important difference in the pedagogical relationship and in the academic organization of this modality, in order to achieve the quality of teaching-learning and to avoid dropout.

The data obtained on dropout in distance courses are expressive, in 2022 the distance CST presented a percentage of 29% of unlinked enrollments, which represents the number of students who dropped out of the course (dropped out). In face-to-face courses, the dropout percentage was 24% (Graph 6).

The percentage of active enrollments is higher in the face-to-face modality, with a higher percentage of enrollments unlinked in distance courses.

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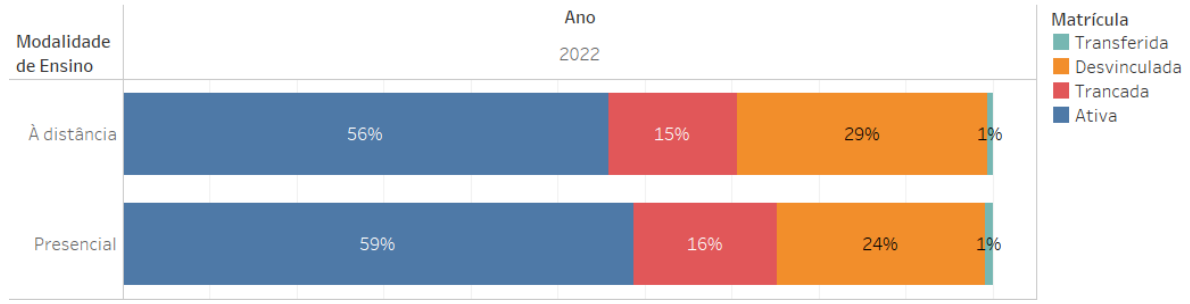
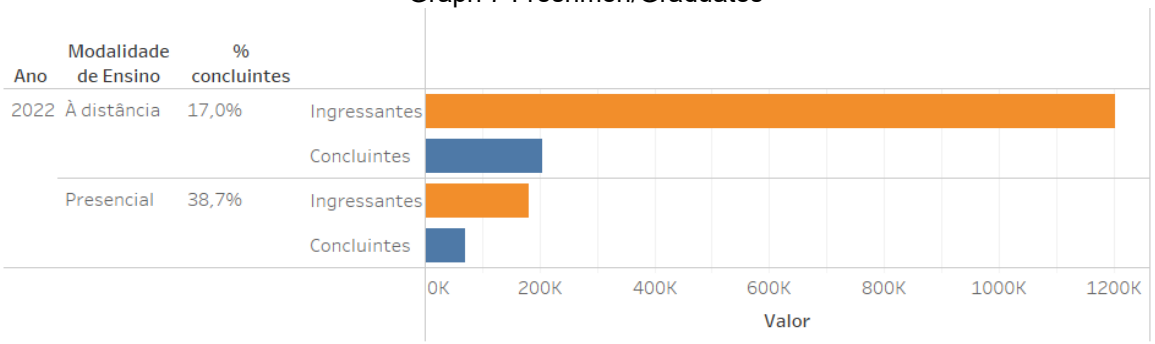
Graph 6 Enrollment status of CST students



Source: Prepared by the authors, based on data from the 2022 Higher Education Census (Brasil, 2023).

Regarding the number of students who completed the course, it can be seen in Graph 7 that the percentage of graduates in relation to freshmen is much lower in distance courses (17%) compared to face-to-face courses (39%).

Graph 7 Freshmen/Graduates



Source: Prepared by the authors, based on data from the 2022 Higher Education Census (Brasil, 2023).

Among the reasons that lead to dropping out of the course, listed by Campos (2022), are: lack of time to study, accumulation of activities that need to be performed, and lack of adaptation to the methodologies of distance education courses, that is, problems related to discipline and the student's autonomy to study alone. Problems with the time for the student to be able to solve a doubt are also highlighted, because, as most courses take place asynchronously, there is no interactivity with the teacher in real time.

Silva and Castro (2022) characterized the factors that contribute to dropout in the distance education modality, based on an extensive bibliographic survey, arrived at the categorization of the main causes of dropout in higher education into three categories: (1) predominance of endogenous factors, intrinsic to HEIs, (2) predominance of exogenous factors, intrinsic to students, and (3) mixed factors, common to HEIs and students. Examples of endogenous factors to HEIs are the infrastructure, available technology and the preparation of teachers to deal with the distance learning modality; exogenous factors

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related to students are, among others, willingness to self-learn, ability to concentrate, intellectual and emotional maturity and self-motivation; and mixed factors are those related to institutional conditions and those related to the intrapersonal perception of the student and the lack of habit to manage time in the execution of activities inherent to distance learning.

The authors confirmed the existence of multiple factors/causes related to dropout in distance learning, which were categorized in their study into eight dimensions: personal/interpersonal, socioeconomic, cognitive, vocational, technological, complementary, structural and didactic-pedagogical activities. This categorization, according to the authors, enables support in academic management and the elaboration of actions to minimize the critical factors that hinder the permanence of students and lead them to drop out of the course. "In addition, the results of the study contribute to the formulation of strategic planning aimed at the management of distance education, considering the reality and particularities of each context" (Silva; Castro, 2022, p. 240).

THE USE OF ARTIFICIAL INTELLIGENCE TO SUPPORT MANAGERIAL AND TEACHING-LEARNING PROCESSES IN HEIS

Artificial Intelligence (AI) is the use of intelligent machines, with computerized systems capable of performing activities that would previously require human reasoning. They are technological systems that learn at scale, through interactions with human beings and in the face of access to the large volume of data and information that is made available to them. Machines process information and make correlations between it, as if they were reasoning (Vendrúscolo; Moré, 2018)

According to Cavalcanti, Tavares, and Pereira Júnior (2021, p. 42), "in the educational context, AI is an interdisciplinary area that integrates methods and results from other sciences, with the aim of developing integrative, adaptive environments that complement and optimize traditional forms of education".

AI can be used by HEIs in their management and teaching-learning processes, as it enables the collection of a large volume of data, which allows streamlining and improving learning processes, defining new ways to provide a more efficient structure and broaden the understanding of the teaching-learning process (Cavalcanti; Tavares; Pereira Júnior, 2021).

In the teaching-learning process, the use of intelligent machines helps in the personalization of teaching, making it possible to create a set of content and support

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material for each student, according to the profile and characteristics, allows the improvement of the tutoring system, expanding interaction, creates new games and simulators, provides new texts, videos and complementary exercises, adjusts the study materials according to the time the student has to study and adjusts the pace of studies (Costa Júnior *et al*., 2023; Nascimento, 2023). This personalization contributes to the improvement of learning, as it provides feedback, analyzes student performance to recognize knowledge gaps, and creates complementary educational resources to address the deficiencies found, in addition to making it possible to identify students who need greater support and provide early help. Specifically on the content available, it is possible for AI to evaluate texts produced, identifying grammatical errors, writing structure, or vocabulary or also assist students in solving mathematical problems (Costa Júnior *et al*., 2023).

According to Silva *et al.* (2023, p. 219), the goal of Artificial Intelligence technologies in distance education organizations "is to create learning environments and promote student success through engagement and interaction, emphasizing an environment of personalized service."

In management processes, the use of AI allows students to be monitored during their studies and to identify patterns of behavior that may lead to dropping out of the course, reducing school dropout (Costa Júnior *et al*., 2023). Still thinking about reducing dropout, Bitencourt, Silva and Xavier (2022, p. 671) defend the "use of Machine Learning and Data Mining, through classification algorithms, to predict school dropout and to identify risk factors associated with school dropout". According to the authors, the early perception of students at potential risk of dropping out allows the Institution to act in advance and create strategies to avoid dropout and encourage the student to remain in the course (Bitencourt; Silva; Xavier, 2022).

AI can also be used as a tool to support teachers in identifying plagiarism, in addition to expanding access to content for students with hearing impairment, as it makes it possible to convert what was said by the teacher into text, in real time, with the use of speech recognition systems, allowing these students to participate in classes in real time (Costa Júnior *et al*., 2023).

Regarding plagiarism, Nascimento (2023) argues that the challenge for professors will no longer be to classify and select research sources, but to check that what was produced by students was not plagiarized or made with the use of AI. The author informs

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that this concern led schools and universities to prohibit the use of *chatbots* by students, unless this use was supervised by a teacher. According to the author, *Sciences Po*, located in Paris, defined punishments for students who use AI, which can go up to expulsion and in the United States, many HEIs determined that homework should be reduced and class activities, written or oral exams, expanded, as a way to curb the use of this intelligence by students (Nascimento, 2023).

METHODOLOGY

The present study assumed a qualiquant character, and the descriptive and exploratory methods were adopted (Sampieri; Collado; Lucio, 2013), combined with a case study of a private Higher Education Institution, with the objective of verifying the difference in the performance of students completing distance and face-to-face higher technology courses, in addition to comparing the grades of the courses and the Institution, obtained in Enade (Yin, 2015).

For the theoretical framework, a survey of texts, articles, dissertations and legislation related to the topic studied was carried out, in addition to data from the Higher Education Censuses, from the years 2001 to 2022, published by Inep, referring to the number of enrollments in higher education courses and the dropout and completion rates of courses.

A survey was carried out on the website of the institution under study, to identify the number of higher education courses offered, teaching modalities, number of face-to-face units and existing distance education centers.

Inep does not publish student performance data in Enade separated by teaching modality. However, in 2018, the analyzed institution offered only higher technology courses in the face-to-face modality and in 2022, it offered the same courses only in the distance modality. 04 (four) courses offered in 2018 (human resources management, financial management, logistics and marketing) and the same 04 (four) courses in 2022 were analyzed. Thus, when comparing the performance of students at this Institution between these two years, a comparison can be inferred between the face-to-face and distance modalities.

As performance criteria, the values of "Standardized Grade – FG", which corresponds to the evaluation of general education, the "Standardized Grade – CE" related to specific knowledge and the "Enade Concept (Continuous)" were used, which corresponds to the final evaluation of the test. These grades and concepts are

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standardised, which allowed the comparison between the years. For the year 2018, the grades were assigned by class and the Institution had more than 01 (one) class for each course analyzed, so the course grade was calculated from the weighted average in the number of students in each class.

To calculate the 2018 CPCs, the average of the grades of each class was considered. The 2022 CPCs and the IGCs (both years) were obtained from Inep's Higher Education Quality Indicators.

The Dropout and Permanence Rates of the Courses were obtained from the microdata of the Higher Education Census published by Inep for the same courses and periods.

RESULTS AND DISCUSSION

PROFILE OF THE INSTITUTION UNDER STUDY

The institution under study is a University Center, headquartered in the city of São Paulo. It was founded as a Faculty in 2000 and in its origin offered only face-to-face higher education courses. In 2019 it became a University Center, at which time it began to expand the number of courses available and started to offer courses entirely in distance learning, in addition to face-to-face ones. Still in 2019, it had 09 educational units with face-to-face classes, only in the city of São Paulo.

From 2020 onwards, it underwent a reformulation: from the 2nd semester of 2020 to 2023 it only offered distance learning courses and in 2024 it also returned to offering face-to-face classes. Currently (October/2024) it offers 46 higher education courses in distance education, of which 22 are technological (04 in the health axis, 12 in management and 06 in technology) and 06 face-to-face (01 in technology in the health axis); of the 09 educational units, face-to-face activities ended in 08 (eight) and only 01 (one) remained in operation, where face-to-face courses are taught; opened 37 distance education centers in 26 cities in 10 Brazilian states. This change observed in the institutional structure corresponds to the national trend for private HEIs: an increase in the offer of distance learning courses and a decrease in face-to-face courses, in addition to the expansion of distance education centers.

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COMPARATIVE ANALYSIS OF STUDENT PERFORMANCE

The grades obtained in the Enade exams of the technology courses in Human Resources, Financial Management, Logistics and Marketing, in the years 2018 and 2022, were considered for comparative analysis.

Students who took the exam in 2018 took the entire course in person, because at that time the University Center offered courses only in the face-to-face modality and those who took the exam in 2022, took the distance course, because from 2020 the Institution stopped offering these courses in person.

For the comparison, the standardized Enade scores referring to General Training (FG) and Specific Knowledge (CE) were considered, as well as the continuous Enade concept. They were compared between students from 2018 and 2022 for the same course. As the grades for the year 2018 were made available by class, the weighted averages were calculated for this work

It can be seen in Table 1 that the scores for the year 2022 are, for the most part, lower than the scores for 2018. The only exception was the General Training grade of the Financial Management course. The Logistics course was the one that observed the greatest reduction, being 16%.

On the other hand, in the specific knowledge test, the Marketing course was the one that presented a decrease in grades, reaching a reduction of 31% and in the Enade concept the reduction was 26%, which went from 2.43 to 1.79.

Table 1 Comparison of Student Performance 2018 and 2022

Year	Higher Technological Courses	Teaching Modality	Number of Registered Graduates	Number of Participating Graduates	Standardized Note - FG	Standardized Note - CE	Enade Concept (Continuous)
2018	HR Management	Face	113	88	2,36	2,51	2,47
2018	Financial management	Face	119	93	1,57	1,92	1,83
2018	Logistics	Face	44	33	2,16	1,50	1,66
2018	Marketing	Face	57	36	2,44	2,43	2,43
2022	HR Management	Distance	188	71	2,06	2,02	2,03
2022	Financial management	Distance	139	33	1,62	1,72	1,69
2022	Logistics	Distance	82	25	1,81	1,35	1,47
2022	Marketing	Distance	103	26	2,13	1,68	1,79
	Difference	HR Management			-13%	-20%	-18%

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		Financial management			3%	-11%	-8%
		Logistics			-16%	-10%	-12%
		Marketing			-13%	-31%	-26%

Source: Prepared by the authors, based on Inep's Higher Education Quality Indicators (2018 and 2022).

These results allow us to infer that in the observed sample there was a decrease in the performance of students in distance courses, when compared to the grades of classes with face-to-face training, as well as a decrease in the Enade Concept score in all courses studied.

A comparison was made of the Institution's general course indexes in the years 2018 and 2022 (Table 2), where it can be seen that the grade decreased, that is, from concept 4 to 3.

Table 2 Comparison of the IGC - 2018 and 2022

Anus	Name of the HEI	Acronym from IES	Number of Courses with CPC in the triennium	Average Undergraduate Concept	IGC (Contínuo)	IGC (Range)
2018	FACULDADE XXX	ISES	51	3,07	3,07332	4
2022	UNIVERSITY CENTER XXX	ISES	18	2,2157	2,2157	3

Source: Prepared by the authors, based on Inep's Higher Education Quality Indicators (2018 and 2022).

Another comparison referred to the Preliminary Course Concept: the Human Resources Management, Logistics, and Marketing courses did not show a change in the indicator between 2018 and 2022, but the Financial Management course had a reduced index from 3 to 2 (Table 3).

Table 3 Comparison of CPC - 2018 and 2022

	Evaluation Area	CPC (Continuous)	CPC (Range)
2018	HR Management	2,860186	3
2018	Financial management	2,379687	3
2018	Logistics	1,95961	2
2018	Marketing	2,373668	3
2022	HR Management	2,204384	3
2022	Financial management	1,910666	2
2022	Logistics	1,780140	2
2022	Marketing	2,116411	3

Source: Prepared by the authors, based on Inep's Higher Education Quality Indicators (2018 and 2022).

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According to Passos *et al.* (2023, p. 8), "the Enade results are the main input to assess the quality of the courses through the Enade Concept and Preliminary Course Concept indicators". Observing the results of the years 2018 and 2022, it was possible to identify that the analyzed Institution obtained the Enade Concept and IGC indices decreased, which allows us to infer that the quality of the courses was downgraded. In view of this scenario, it conceives the HEI to adopt mechanisms aimed at monitoring students, periodically evaluating their performance, to identify knowledge gaps early and create new educational resources to complement the study and address the deficiencies found, thus ensuring better academic training and an improvement in the quality of the courses. According to Costa Júnior *et al.* (2023), the monitoring of students could be done with the use of AI, through intelligent systems designed for this purpose.

The students' score alone in the two exams is not enough to determine whether there was in fact a difference in performance, as other factors may have contributed to the result, such as the degree of difficulty of the tests, so the comparison of the scores was also made, considering the national averages obtained by Brazilian students (Table 4).

In this table, the difference between the IES test scores and the Brazilian average for the years 2018 and 2022 were calculated. These differences were also calculated in standard deviation units. The "Distance" column indicates whether the IES score has improved or worsened in relation to the Brazilian average, in standard deviation units. Values with a modulus lower than 1 indicate that there was no significant change. Values lower than -1 indicate that the IES score has approached the Brazilian average, that is, that the HEI has improved the score. Values greater than 1 indicate that the HEI moved away from the Brazilian average, that is, it worsened.

Table 4 Student Performance 2018 and 2022 – Institution x Brazil

						Difference in terms of Standard Error	Difference Brazil class (Brazil-class)		Difference between the Brazilian Panel due to standard error (Brazil-Class)/EP)		Distance	Comment
						(M2022-M2018)/ (EP2022+EP2018)	2018	2022	2018	2022		
		Financial Management - 2018		Financial Management - 2022								
United		COMING	Brazil	COMING	Brazil							
Overall Result	Average	34,0	40,1	33,8	37,2	-0,06	-6,06	-3,40	-2,71	-2,00	-0,71	HIS*
	Standard Error	2,2	0,2	1,7	0,2		2,24	1,70				
Genera — Educati	Average	34,5	39,8	41	45,0	1,24	-5,32	-4,00	-2,38	-1,33	-1,05	Improved
	Standard Error	2,2	0,2	3	0,2		2,24	3,00				

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Specific Comp.	Average	33,9	40,1	31,4	34,5	-0,55	-6,23	-3,10	-2,42	-1,63	-0,79	HIS*
	Standard Error	2,6	0,2	1,9	0,2		2,57	1,90				
		Human Resources - 2018		Human Resources - 2022								
United		COMING	Brazil	COMING	Brazil							
Overall Result	Average	43,2	42,2	40,1	42	-0,99	0,96	-1,90	0,60	-1,27	1,87	Worse
	Standard Error	1,6	0,1	1,5	0,1		1,60	1,50				
General Educati	Average	37,6	38,0	40,8	42,9	0,76	-0,35	-2,10	-0,16	-1,11	0,95	HIS*
	Standard Error	2,2	0,1	1,9	0,1		2,25	1,90				
Specific Comp.	Average	45,0	43,6	39,9	41,7	-1,50	1,41	-1,80	0,78	-1,13	1,91	Worse
	Standard Error	1,8	0,1	1,6	0,1		1,81	1,60				
		Marketing - 2018		Marketing - 2022								
United		COMING	Brazil	COMING	Brazil							
Overall Result	Average	47,0	48,1	39,3	44,3	-2,10	-1,09	-5,00	-0,61	-2,63	2,02	Worse
	Standard Error	1,8	0,2	1,9	0,2		1,78	1,90				
General Educati	Average	41,2	42,6	44,1	47,6	0,48	-1,38	-3,50	-0,05	-1,06	1,01	HIS*
	Standard Error	2,7	0,2	3,3	0,2		2,74	3,30				
Specific Comp.	Average	49,0	50,0	37,7	43,2	-2,87	-1,05	-5,50	-0,54	-2,75	2,21	Worse
	Standard Error	1,9	0,2	2,0	0,2		1,92	2,00				
		Logistics - 2018		Logistics - 2022								
United		COMING	Brazil	COMING	Brazil							
Overall Result	Average	36,3	41,2	32,6	38,6	-0,79	-4,88	-6,00	-2,18	-2,40	0,22	HIS*
	Standard Error	2,2	0,1	2,5	0,1		2,23	2,50				
General Educati	Average	37,8	39,1	37,8	42,1	0,00	-1,32	-4,30	-0,46	-1,13	0,67	HIS*
	Standard Error	2,9	0,2	3,8	0,2		2,88	3,80				
Specific Comp.	Average	35,8	41,9	30,9	37,4	-0,97	-6,11	-6,50	-2,60	-2,41	-0,19	HIS*
	Standard Error	2,3	0,1	2,7	0,1		2,35	2,70				

Source: Prepared by the authors, based on Inep's Higher Education Quality Indicators (2018 and 2022).
*No significant change

Comparing the grades obtained by the students of the University Center with the average of the grades at the national level, it is possible to identify that there was a decrease in the performance of the students of the Human Resources and Marketing courses; as for the performance of students in the Financial Management course, there was an improvement; with regard to the Logistics course, there was no significant change.

According to Costa Júnior *et al.*, AI

> can be used to create intelligent educational resources, through more interactive tutoring systems, educational games, simulators and other educational resources that can improve student learning (individualizing content for each student), [...] identify patterns in student learning behavior and adjust the pace of teaching and [...] predict student performance based on their record data and performance history. This can help educational institutions identify students who need additional support and provide early interventions (Costa Junior *et al.*, 2023, p.251).

It is assumed that the use of AI makes it possible to monitor the performance of students during the development of the course, checking the gaps found, to adapt the

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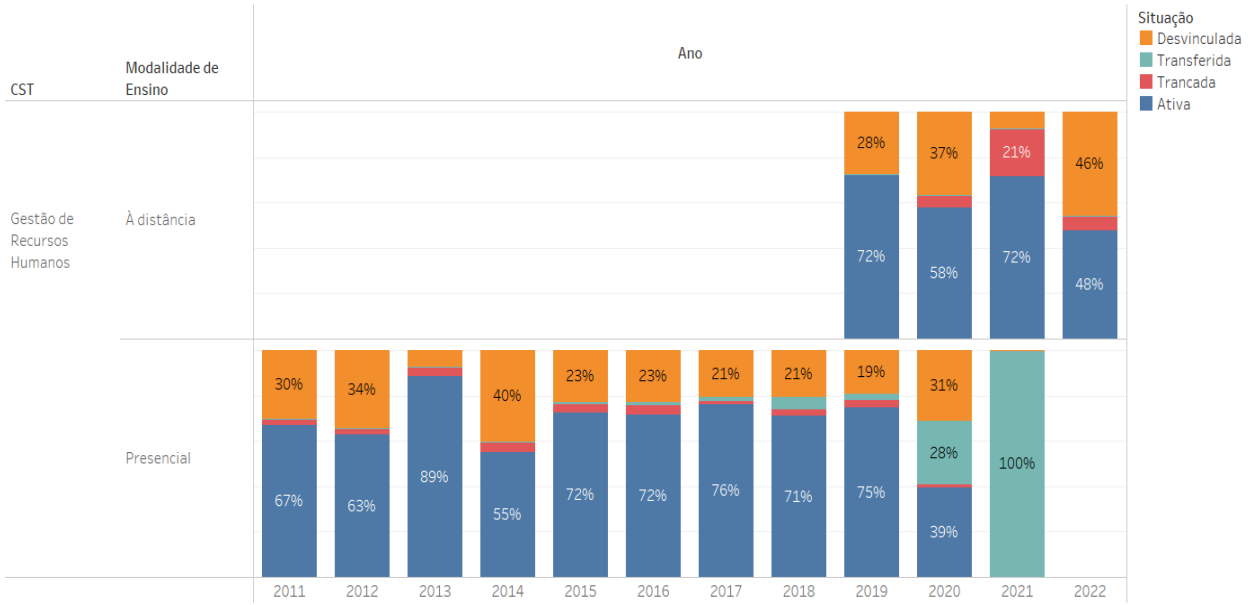
content, with the availability of more support materials, such as texts, videos, and complementary exercises (Nascimento, 2023), which would imply an improvement in student performance.

ANALYSIS OF DROPOUT RATES AND PERMANENCE IN THE COURSE

Analyzing the data on permanence and dropout in the HEI courses under study, a transition from the face-to-face modality to the distance modality is observed as of 2020, as previously mentioned. Until 2018, when the courses were face-to-face, the number of active enrollments remained around 75% and unlinked enrollments (associated with abandonment of the course) remained around 25%. In 2022, active enrollments were around 50%, while unlinked enrollments were around 45% (Graphs 08 to 11).

Graph 8 Enrollment Status – Human Resources Management



Source: Prepared by the authors, based on data from the 2022 Higher Education Census (Brasil, 2023).

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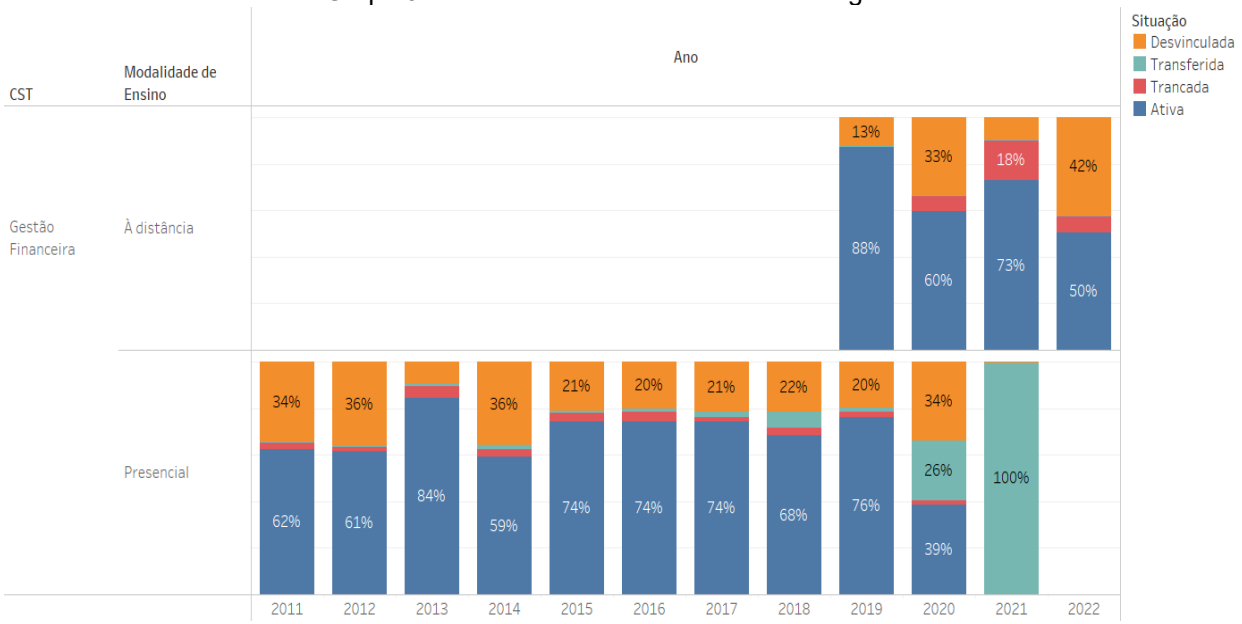
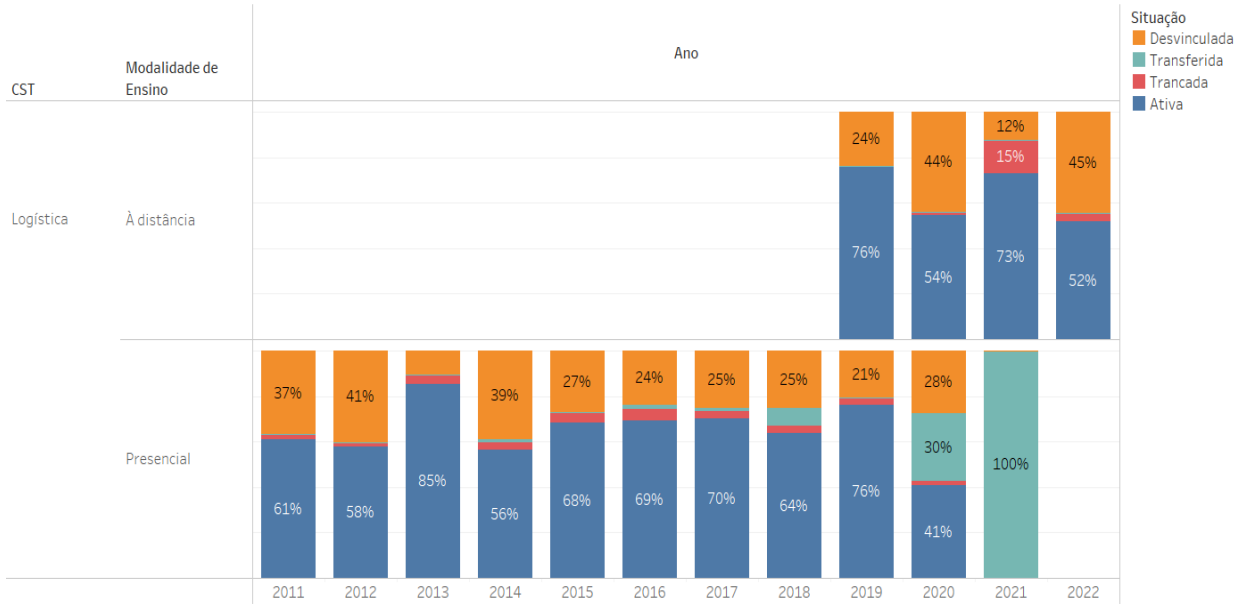
Graph 9 Enrollment Status – Financial Management



Source: Prepared by the authors, based on data from the 2022 Higher Education Census (Brasil, 2023).

Graph 10 Enrollment Situation – Logistics



Source: Prepared by the authors, based on data from the 2022 Higher Education Census (Brasil, 2023).

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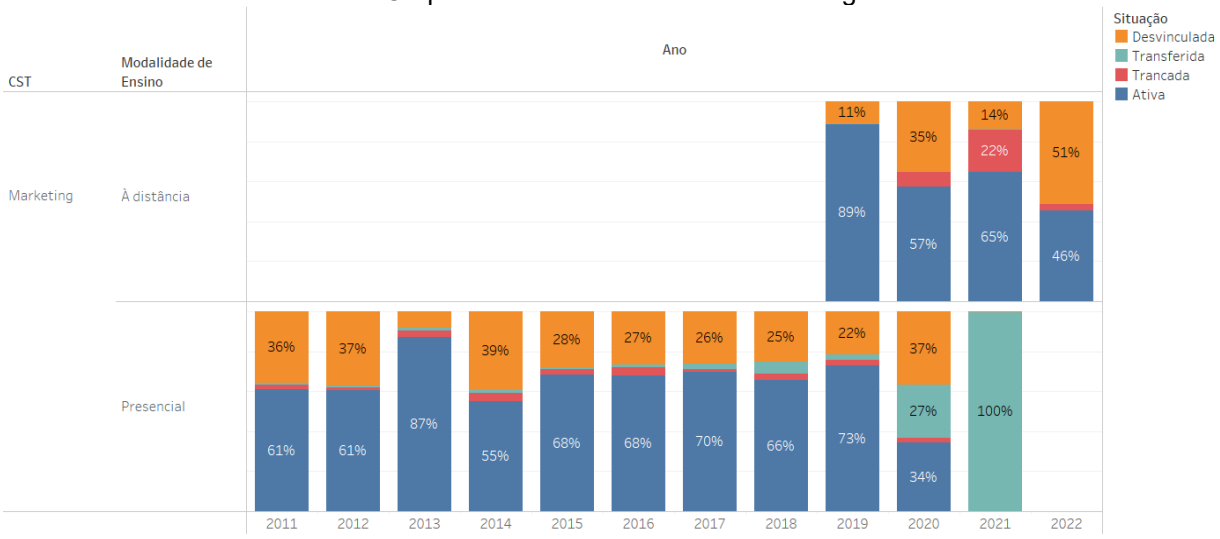
Graph 11 Enrollment Status – Marketing



Source: Prepared by the authors, based on data from the 2022 Higher Education Census (Brasil, 2023).

These results show the high dropout rate in distance learning courses at the institution studied, which is in line with national data, reported in Inep's Higher Education Census (2023).

According to Bitencourt, Silva and Xavier (2022), it is essential that the institution periodically monitors students at potential risk of dropping out and acts in advance, in order to avoid dropout; the authors propose the use of AI in this process of analysis and monitoring of students. To this end, the AI would use algorithms defined from a database formed by the Institution, to define the profile of the dropout student and the risks of dropout, consequently it would be possible to establish strategies to minimize these risks.

FINAL CONSIDERATIONS

The article brought to light the perspective of investigating the performance of higher education courses in distance technology and the use of artificial intelligence to improve the quality of courses. In this sense, the existing bibliography was used, combined with the apprehension of the current stage of these courses, having as an anchor the higher education census in 2022, as well as the strategies for evaluating the performance of graduates.

There was also an attempt to investigate the phenomenon of dropout and the perspective of using AI in the monitoring of management and teaching-learning processes.

Answering the research question, it was described how Artificial Intelligence systems can be used by HEIs to improve management and teaching-learning processes in order to

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minimize the dropout rate and implement the quality of the courses offered. Among the applications of AI, the following were highlighted: the early analysis of the profile of the student prone to dropout; the personalization of teaching according to the student's profile; the identification of student learning gaps with the consequent availability of extra content; and the correction of activities by the intelligent system without the interference of the teacher.

Regarding the general objective of the article, comparing the results of Enade for the years 2018 and 2022, it was shown that of the 04 (four) courses studied, Human Resources Management, Logistics and Marketing showed a reduction in the grade of the General Training test and the Financial Management course showed an increase of 3%; in the Specific Knowledge test, all four courses had a reduction in the score, with emphasis on the Marketing course, which showed the greatest reduction, being 36%. In the Enade Concept, all grades also reduced, with the Marketing course showing the highest downgrade, of 26%. The Institution's IGC reduced from 4 to 3 and the CPC remained the same, with the exception of the Financial Management course, which decreased from 3 to 2. Regarding the comparison between the performance of the Institution's courses and the national average in the respective Enades (2018 and 2022), it was found that there was a decrease in the grades of the courses: Human Resources Management and Marketing, while there was an improvement in the grades of the Financial Management course. The grades of the Logistics course did not show significant changes. As for dropout, until 2018 (when the courses were face-to-face), the dropout rate remained around 25%, however in 2022 (in distance education courses), the rate corresponded to 45%. It is concluded that, according to the sample studied, distance learning courses presented a lower performance in relation to face-to-face courses, and it is necessary for the Institution to adopt quick measures aimed at identifying the reasons that led to this drop in the quality of its courses and promoting actions aimed at improving the performance of the courses and, for this, it could use AI systems.

As for the first specific objective, the evolution of enrollments in higher technology courses was characterized, identifying that the CST grew around 2500% from 2001 to 2022, with the greatest growth observed being in distance technological courses, in private institutions, in the "management and business" and "information and communication" axes.

In the second specific objective, to identify the instruments that integrate the evaluation process of higher education courses in distance technology, it is concluded that

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the Enade score is currently considered for the evaluation of courses and HEIs, in addition to the indexes of the Enade Concept, the CPC and the IGC. According to these indicators, the quality of the Institution and the courses offered by it has been measured.

When analyzing the relationship between admission to distance learning technology higher education courses and their completion, referring to the third specific objective, it was found that in 2022 the completion rate in these courses was 17% and the dropout rate was 29%.

Finally, the fourth objective was also achieved, as it was suggested to indicate the use of Artificial Intelligence in HEIs as a strategic resource for Institutions, in their management processes; the teachers, as methodological support for content exposure and monitoring of the student's development; and the students, in the personalization of teaching, according to the profile and individual characteristics of the student.

It is suggested that in future studies the factors that contributed to the exponential growth of enrollments in higher technology courses in the "management and business" and "information and communication" axes be investigated.

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REFERENCES

1. Basso, C. A. M., et al. (2023). Educação a distância no ensino superior: relato de experiências em uma universidade catarinense. Revista Foco, 16(3), e1466-e1466.

2. Bittencourt, W. A., Silva, D. M., & Xavier, G. C. (2022). Pode a inteligência artificial apoiar ações contra evasão escolar universitária? Ensaio: Avaliação e Políticas Públicas em Educação, 30(116).

3. Brasil. (2017). Decreto 9.057, de 25 de maio de 2017. Regulamenta o art. 80 da Lei nº 9.394, de 20 de dezembro de 1996, que estabelece as diretrizes e bases da educação nacional. Available at: https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2017/decreto/d9057.htm. Accessed on: August 6, 2024.

4. Brasil. (1996). Lei 9.394, de 20 de dezembro de 1996. Estabelece as diretrizes e bases da educação nacional. Available at: https://www.planalto.gov.br/ccivil_03/leis/l9394.htm. Accessed on: August 6, 2024.

5. Brasil, Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (Inep). (2023). Censo da Educação Superior 2022: microdados. Brasília, DF: Inep. Available at: https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/microdados/censo-da-educacao-superior. Accessed on: September 30, 2024.

6. Brasil, Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (Inep). (n.d.). Indicadores de Qualidade da Educação Superior. Available at: https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/indicadores-educacionais/indicadores-de-qualidade-da-educacao-superior. Accessed on: August 18, 2024.

7. Campos, P. K. (2022). A evasão no ensino superior na modalidade EaD: um estudo sobre as motivações e problemas decorrentes do processo. Revista Científica e-Locução, 1(22), 22-22.

8. Cavalcanti, W. M., Tavares, E., & Pereira Júnior, J. L. C. (2021). Aplicação da inteligência artificial no ensino superior: Áreas e características. Revista ADM. MADE, 25(1), 040-061.

9. Centro Universitário Sumaré. (n.d.). Dados sobre cursos ofertados, unidades educacionais e polos EaD. Available at: https://sumare.edu.br/graduacao/ead/estetica-e-cosmetica. Accessed on: October 1, 2024.

10. Dias Sobrinho, J. (2010). Avaliação e transformações da educação superior brasileira (1995-2009): do provão ao Sinaes. Avaliação, Campinas; Sorocaba, SP, 15(1), 195-224.

11. Gomes, E. D., et al. (2020). Avaliação de desempenho de cursos de graduação ofertados na modalidade de Educação a Distância. Avaliação, Campinas; Sorocaba, SP, 25(03), 503-524. Available at: https://www.scielo.br/j/aval/a/nZ8BDBP4PqRf8zxW4Fbd8Pv/?lang=pt&format=pdf. Accessed on: August 4, 2024.

12. Costa Júnior, J. F., et al. (2023). A inteligência artificial como ferramenta de apoio no ensino superior. Rebena - Revista Brasileira de Ensino e Aprendizagem, 6, 246-269.

13. Mattos, M. C. C. M., & Silva, M. C. R. F. (2020). Precarização e privatização das políticas públicas na educação a distância. Educação, 45, 1-22.

Revista ARACÊ
ISSN: 2358-2472

14. Nascimento, C. C. (2023). Inteligência artificial no ensino superior: Da transformação digital aos desafios da contemporaneidade. Publicações.

15. Nunes, V. B., Albernaz, J. M., & Nobre, I. A. M. (2009). Avaliação de cursos a distância. CEFOR, publicações ESUD. Available at: https://cefor.ifes.edu.br/images/stories/publicacoes/2009_avaliao%20de%20cursos%20a%20distncia.pdf. Accessed on: October 6, 2024.

16. Passos, G. O., et al. (2023). Qualidade da Licenciatura em Educação Física da Universidade Estadual de Goiás (UEG) medida pelo Enade e CPC. XI Jornada Internacional de Políticas Públicas. Maranhão, Brasil. Available at: https://www.joinpp.ufma.br/jornadas/joinpp2023/images/trabalhos/trabalho_submissaoId_3142_314264983da113f7b.pdf. Accessed on: October 4, 2024.

17. Ribeiro, W. L., & Guerra, M. G. G. V. (2019). Avaliação de cursos a partir do Sinaes: uma análise para melhoria da qualidade na Universidade Federal da Paraíba. Rev. Educ. Questão, 57(53), e17064. Available at: http://educa.fcc.org.br/scielo.php?script=sci_arttext&pid=S0102-77352019000300007&lng=pt&nrm=iso. Accessed on: October 6, 2024. Epub September 19, 2019. https://doi.org/10.21680/1981-1802.2019v57n53id17064.

18. Rodrigues, R. S. (1998). Modelo de avaliação para cursos no ensino a distância: estrutura, aplicação e avaliação. (Master's thesis). Programa de Pós-Graduação em Engenharia de Produção, UFSC.

19. Sampieri, R. H., Collado, C. F., & Lucio, M. P. B. (2013). Metodologia de pesquisa (5th ed.). Porto Alegre: Penso.

20. Semesp. (2023). Mapa do ensino superior no Brasil (13th ed.). São Paulo: SEMESP.

21. Silva, J. C., & Castro, M. C. D. (2022). Dimensões relacionadas à evasão na educação a distância: análise de uma proposta de categorização. Revista Valore, 7, 217-252.

22. Silva, M. V. M., et al. (2023). Inserção da inteligência artificial nos cursos a distância. Revista Amor Mundi, 4(5), 215-221.

23. Vendrúsculo, J. B. G., & Moré, R. P. O. (2018). Contribuições da inteligência artificial nos sistemas de informação de apoio a gestão universitária.

24. Yin, R. K. (2015). Estudo de Caso: Planejamento e Métodos. Bookman Editora.