REFLECTIONS ON ACADEMIC ANALIYTICS MODEL IN COMMUNITY HIGHER EDUCATION INSTITUTIONS: PILOT STUDY

REFLEXÕES SOBRE UM MODELO DE ANALÍTICA ACADÊMICA EM INSTITUIÇÕES COMUNITÁRIAS DE ENSINO SUPERIOR: ESTUDO PILOTO

REFLEXIONES SOBRE UN MODELO DE ANALÍTICA ACADÉMICA EN INSTITUCIONES COMUNITARIAS DE EDUCACIÓN SUPERIOR: ESTUDIO PILOTO

Fábio Josende PAZ[1]
Silvio Cesar CAZELLA[2]

ABSTRACT: Academic Analytics is a relatively new area that brings analytics and business intelligence concepts to higher education. This article aims to report the results of a pilot study of the application an Academic Analytics model in a Community Institution of Higher Education. The research method was experimental and used content analysis as a methodology. The results are partial, but they are promising, we highlight the optimization of time, the quality of the information presented and the good evaluation of the coordinators in relation to support decision-making, helping the management process.

KEYWORDS: Academic analytics. Higher education. Academic management.

RESUMO: *Analítica Acadêmica é uma área relativamente nova que traz conceitos de análise e business intelligence para o ensino superior. Este artigo tem por objetivo reportar os resultados de um estudo piloto da aplicação de um modelo de Analítica Acadêmica em um Instituição Comunitária de Ensino Superior. O método de pesquisa foi a experimental e utilizada a análise de conteúdo como metodologia. Os resultados são parciais, mas apresentam-se promissores, destacamos a otimização do tempo, qualidade nas informações apresentadas e a boa avaliação dos coordenadores em relação ao apoio a tomada de decisão, auxiliando o processo de gestão.*

PALAVRAS-CHAVE: *Analítica acadêmica. Ensino superior. Gestão acadêmica.*

RESUMEN: *La analítica académica es un área relativamente nueva que lleva la analítica y los conceptos de business intelligence a la educación superior. Este artículo tiene como objetivo reportar los resultados de un estudio piloto de la aplicación de un modelo de Analítica Académica en una Institución Comunitaria de Educación Superior. El método de*

[1] Federal University of Rio Grande do Sul (UFRGS), Porto Alegre – RS – Brazil. Doctoral candidate in the Postgraduate Program in Informatics in Education (PPGIE). ORCID: https://orcid.org/0000-0003-0089-8984. E-mail: fabiojpaz@gmail.com
[2] Federal University of Ciências da Saúde de Porto Alegre (UFCSPA), Porto Alegre – RS – Brazil. Vice-Coordinator of the Postgraduate Program in Information Technologies and Health Management. Doctor in Computer Science (UFRGS). ORCID: https://orcid.org/0000-0003-2343-893X. E-mail: silvio.cazella@gmail.com

investigación fue experimental y utilizó el análises de contenido como metodología. Los resultados son parciales, pero prometedores, destacamos la optimización del tiempo, la calidad de la información presentada y la buena evaluación de los coordinadores en relación al apoyo a la toma de decisiones, ayudando al proceso de gestión.

PALABRAS CLAVE: *Analítica académica. Educación superior. Gestión académica.*

Introduction

In a context of continuous expansion of the offer of educational data, the need for analysis and treatment of these data emerges to generate intelligence for educational managers, among them the course coordinator, who according to Cardim (2010), Argenta (2011) and Castro (2013) are central figures in the academic management process, and that they are directly involved with the marketing, administrative, operational and financial areas.

In this sense, coordinating an undergraduate course is not a simple task, it requires a lot of dedication and knowledge, in addition to an in-depth look at managerial and administrative issues, which can often leave the bureaucratic coordinator. English Academic Analytics, which according to Campbell, Deblois, and Oblinger (2007) and Campbell and Oblinger (2007), is a tool that provides the necessary data to support operational and financial decision-making and its focus is on the management of Superior Education Institutions, using indicators and panels on the performance of the different areas, a combination of administrative analysis and learning (BARNEVELD; ARNOLD; CAMPBELL, 2012; SIEMENS, 2012).

Filatro (2021) summarizes how the use of macrodata originated from the information systems of educational institutions or corporate education departments for administrative or managerial decision making.

Thus, systems based on Academic Analytics should be used by administrators, academic managers (deans, pro-deans, center directors, course coordinators, etc.), quality controls, marketing, HEI funders for support and guidance for actions (CAMPBELL; DEBLOIS; OBLINGER, 2007; CAMPBELL; OBLINGER, 2007; LONG; SIEMENS, 2011).

From this perspective, authors cite some significant advantages in the use of Academic Analytics in the Management of HEIs: improved knowledge flow throughout the organization; benchmarking and other comparisons with other colleges/universities; the perception of student success in relation to other school systems; cost reduction; informed decision making (greater knowledge about factors that impact learning success); more

effective allocation of resources (as a result of accurate and up-to-date information within the institution); greater efficiency in saving financial and human resources; better course planning; improvement in the process of attracting and retaining students; optimization in classroom scheduling; maximize alumni donations; better organization and visualization of data; (ANDRADE; FERREIRA, 2016; BARNEVELD; ARNOLD; CAMPBELL, 2012; MAT *et al.*, 2013; PALMER, 2013; PAZ; CAZELLA, 2019).

Given the above, this article presents the partial results/pilot study of the evaluation of an Academic Analytics model applied in a Community Institution of Higher Education, in this sense, it intends to verify if the model is helping to obtain faster, more efficient and relevant information for undergraduate course coordinators and support decision-making at the academic/administrative level of an undergraduate course. This article is organized into 5 sections, including the introduction. In section 2, the Academic Analytics model applied in the study is briefly presented, then the materials and methods used are presented. In section 4, the results of the pilot study are discussed. Finally, we present the final considerations, in section 5, and the bibliographic references that support this study.

The present study was submitted and approved by the Ethics and Research Committee (CEP) of the Federal University of Health Sciences of Porto Alegre and was registered under the number CAEE 35981820.9.0000.5345, on the Brazil platform. An Authorization was requested from the users involved in the study through the Free and Informed Consent Term (ICF) for the use of the data obtained and the confidentiality of the data collected will be guaranteed in accordance with current legislation. Said project does not fall under the terms of Resolution no. 466/12 of CONEP and law no. 11,794 of 8 October 2008, which regulate CEP and CONEP and is
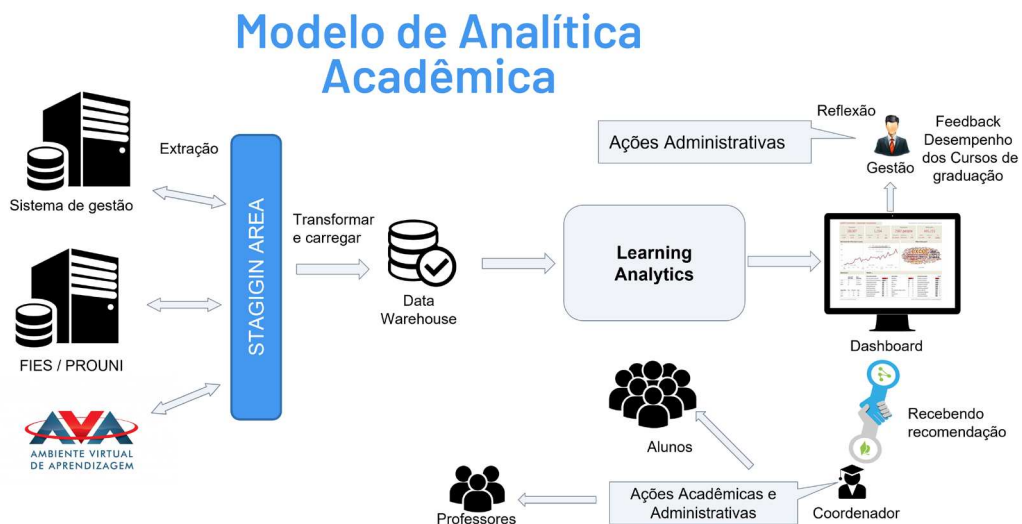
Academic Analytics Model

The Academic Analytics Model applied in the pilot study was designed by (PAZ; CAZELLA, 2020) to support coordinators responsible for managing undergraduate courses at Community Higher Education Institutions (CHEI) with a focus on improving decision-making.

For that, some requirements were listed as essential for the model, such as:

- automate the data analysis process;
- use Learning Analytics to facilitate data access to non-experts in the field;

- that the framework has a good Usability;
- assemble panels (Dashboards) with the main academic and administrative indicators that help the management of coordinators of undergraduate courses at CHEI;
- and finally, include cultural and Brazilian society issues, in addition to including indicators that help in the process of evaluations proposed by the National Institute of Study and Research (INEP) of the Ministry of Higher Education (MEC).

Figure 1 – Architecture of the Academic Analytics model

Source: Paz and Cazella (2020)

Figure 1 shows the architecture of the proposed Academic Analytics model, which seeks information from data sources: Academic Management System, Student Financing Fund (FIES) / University for All Program (PROUNI) and the Moodle platform , which is the Virtual Learning Environment in which the study was conducted, the flow of activities begins with the extraction of data from these sources.

At this stage, the tasks of extracting, treating and cleaning this data and inserting it into the Data Warehouse (DW) base take place. This data is then temporarily stored in the Staging Area[3] to assist in the transition to the DW, this area is used for data processing during the extraction, transformation and loading process. A Data Warehouse can be seen as a data

---

[3] The Staging Area is a temporary location where data from source systems is copied. In this way, instead of accessing the data directly from the source, the "transformation" process takes the data from the Staging Area to process and deliver the data. The benefit of this feature is being able to store the data in its "raw" source to be able to work on it instead of always having to access the Data Source, improving performance and data security.

warehouse used to store information related to the organization's activities in a consolidated database, this design favors reporting, analysis of large volumes of data and obtaining strategic information that can facilitate decision making. Thus, the data are consulted by Learning Analysis tools and techniques (Learning Analytics) for presentation in Dashboards format (visual panels) in order to generate relevant knowledge for undergraduate course coordinators so that they can assist in academic and administrative decision making.

In Figure 2, the main interface of the Academic Analytics model, the coordinator's panel, is visualized. Cazella (2020).

Figure 2 – Coordinator panel interface
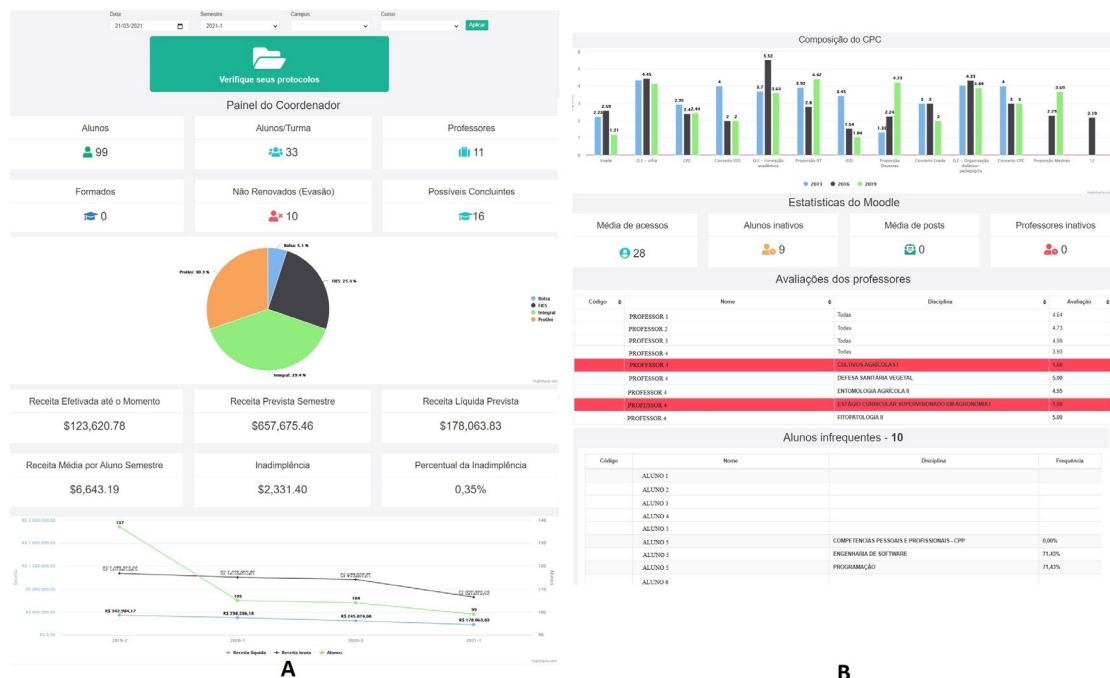
Source: Paz and Cazella (2020)

Figure 2 presents the coordinator's panel interface, highlighting the macro numbers of the selected undergraduate course, allowing in this panel to choose previous semesters and specific dates for comparison, it is important to note that the numbers and results presented are hypothetical, used only to demonstrate the model functionality. In this panel are the indicators identified as relevant by the coordinators (PAZ; CAZELLA, 2019, 2020).

Side A brings information about students, teachers, trainees, dropout and possible course graduates, in addition to presenting a chart with the division of students regarding the type of incentive (scholarships, etc.), followed by financial information such as default, in addition to a line chart showing the active students by semester and the gross and net income

generated by them, allowing a quick analysis of the growth or not of the course. On side B, we highlight the results of the latest ENADE assessments and the composition of the CPC, the indicators evaluated by INEP for undergraduate courses, as well as Moodle access statistics, assessments by teachers in their disciplines and infrequent students.

Materials and methods

This research is part of a Doctoral research and originates from an exploratory research, has a mixed approach (quali-quantitative), with content analysis as an analysis method, which according to Bardin (2016) consists of a set of analysis techniques communications, which aims to enrich the reading of the collected data (corpus) and overcome uncertainties, thus focusing only on the content of the text, without making relationships beyond this.

The steps of the technique proposed by Bardin are organized into three phases: 1) pre-analysis, 2) exploration of the material and 3) treatment of results, inference and interpretation.

Pre-analysis is the phase in which the material to be analyzed is organized with the objective of making it operational, systematizing the initial ideas. It is about the organization itself through four stages: (a) floating reading, which is the establishment of contact with the data collection documents, moment in which the text begins to be known; (b) choice of documents, which consists of demarcating what will be analyzed; (c) formulation of hypotheses and objectives; (d) referencing indexes and elaboration of indicators, which involves the determination of indicators through text clippings in the analysis documents (BARDIN, 2016).

The exploration of the material constitutes the second phase, which consists of the exploration of the material with the definition of categories (coding systems) and the identification of the registration units (unit of meaning to be coded corresponds to the segment of content to be considered as a base unit, aiming at to categorization and frequency counting) and of the units of context in the documents (unit of understanding to encode the unit of record that corresponds to the segment of the message, in order to understand the exact meaning of the unit of record). The exploration of the material is an important step, because it will allow or not the richness of interpretations and inferences. This is the analytical description phase, which concerns the corpus (any textual material collected) submitted to an

in-depth study, guided by hypotheses and theoretical references. Thus, coding, classification and categorization are basic at this stage (BARDIN, 2016).

The third phase concerns the treatment of results, inference and interpretation. This step is intended for processing the results; there is the condensation and highlighting of information for analysis, culminating in inferential interpretations; it is the moment of intuition, of reflective and critical analysis (BARDIN, 2016).

The target audience of the research are the undergraduate course coordinators in the face-to-face modality of a Community Institution of Higher Education - CHEI. A convenience sample was chosen, as the subjects must accept to participate in the research and use the proposed Academic Analytics model, the sampled individuals agreed to the Free and Informed Consent Term (ICF).

To evaluate the model, the evaluation questionnaire of the Academic Analytics Model was used, prepared by the researcher, it contains 6 open and closed questions with five-point Likert scale response options, the institution's institutional documents and records were also used to assist in the triangulation of the data obtained in the study. Among the documents to be analyzed, we can mention: reports of undergraduate courses (students, suspensions, cancellations, frequency in disciplines, default, existing indicators, among others) and at the end, interviews were carried out with course coordinators. In addition, the study aimed to evaluate the usability of the model, for which we chose to use a questionnaire that contemplated Nielsen's precepts, the System Usabilty Scale - SUS (BROKE, 2013).

The Study was applied to 04 ICES undergraduate course coordinators, the presentation of the model and availability for use took place on 30 March 2021, the invitation to the coordinators respected the following profile: coordinators who have more than one course under their management and from different areas: one in the health area, one in technology, one in the teaching degree programs and a coordinator in the management area. Also, coordinators who had less than 3 years, between 3 and 5 years and more than 5 years of experience in management of undergraduate courses.

Results

First, we sought to **evaluate the usability and satisfaction of users** in using the Academic Analytics model, for which the System Usability Scale – SUS questionnaire was used, applied on 28 April 2021 to the 04 coordinators, Broke (2013) states that the SUS allows a subjective and simple assessment, it is composed of 10 items that show a global view

of the user in relation to the system, using a Likert scale (values 1 – strongly disagree to 5 – strongly agree). To calculate the SUS score, it is first necessary to verify the value chosen by the user in the question (from 1 to 5), in the odd questions, one is subtracted from the chosen scale, example: user chose scale 4 (4 - 1 = 3) his answer will be 3, in the even questions, 5 is calculated minus the scale chosen by the user, example user chose 4 (5 - 4 = 1) his answer will be 1. After all 10 answers will be added and multiplied by 2.5 to obtain the SUS score. According to Broke (2013) the SUS scores have a range from 0 to 100, where less than 51 is considered bad, greater than 71 is good, greater than 86 is excellent and greater than 91 is the best achievable, this scale will be used to evaluate the usability of the created system.

Figure 3 – SUS score by coordinator
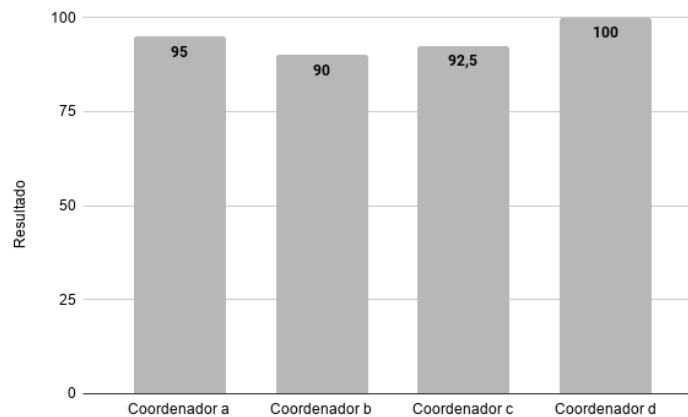
Source: Broke (2013)

Figure 3 shows the responses of all coordinators participating in the study, where the average obtained was greater than 90 points on the SUS scale, which, according to Broke (2013), can be considered an excellent result, as scores above 86 represent very good experiences with a high level of user satisfaction, a result confirmed in the individual interviews with the coordinators, which will be presented next. Continuing, the application of the questionnaire and the interview were carried out with the intention of validating the research instruments and analyzing preliminary data of the study, among them: if the model is helping to obtain faster and more efficient information and if these are important for this user profile, analyze whether this information is supporting decision-making at the academic/administrative level of an undergraduate course.

Profile of respondents, Coordinator a: 28 years of institution, master, more than 10 years of experience in management of undergraduate courses, coordinates more than one course in different CHEI campuses; Coordinator b: 15 years at the institution, master, 3 years

in course coordination; Coordinator c: 18 years at the institution, PhD, 8 years in the coordination of courses, coordinates more than one undergraduate course on campuses outside the headquarters; Coordinator d: 5 years at the institution, PhD, 2 years coordinating undergraduate courses, coordinates more than one course.

Regarding the questions:

• From the Academic Management Point of View, the Academic Analytics Model supports decision-making at the undergraduate course management level.

• From the Academic Management Point of View, and in the Academic Analytics Model, the system views are adequate and can support the management decisions of an undergraduate course.

• The proposed Academic Analytics Model improves resources to support the management of undergraduate courses compared to other solutions known and adopted by my HEI.

The coordinators were unanimous and fully agree with these statements. This demonstrates that in their perception the system supports their management process. Also, the coordinators were asked about the views offered in the Academic Analytics Model, whether they support academic management and decision-making for the management of an undergraduate course regarding each item presented in Table 1.

Table 1 – Coordinators' answers

Item	TOTALLY DISAGREE	DISAGREE	INDIFFERENT	AGREE	TOTALLY AGREE
Prevention monitoring				2	2
Evasion monitoring				2	2
Default Monitoring				1	3
Monitoring of general student indicators				1	3
Undergraduate course monitoring					4
Monitoring of MEC indicators				2	2
Monitoring of basic financial indicators				1	3
Identification of the need for formation for the faculty		1		2	1
Undergraduate course planning				2	2

Source: Devised by the authors

In Table 1, we highlight the agreement or total agreement on the part of the coordinators on practically all items, with the exception of "identification of the need for formation for the faculty", with one disagreement. A positive highlight was the item

"monitoring the undergraduate course" where total agreement was unanimous. For the contribution and evaluation of this work, seeking continuous improvement, participants were asked to express their observations and experiences with the use of the Academic Analytics model, through reports based on six questions that can be seen in Appendix D, therefore , individual interviews were carried out from 30/04/2021 to 03/05/2021, for the analysis of the interviews, Content Analysis was used following the methodology of Bardin (2016), which has already been described in the Materials and methods.

Stage 1: Pre-Analysis or Ordering of the data: the interviews were transcribed in full, then a floating reading of all the material was carried out to discard any text not suitable for the research, then an exhaustive reading of all the content was carried out and generated a cloud of words to identify the most frequent terms used by respondents (FIGURE 4), thus it was possible to determine the central ideas that will be analyzed later.

Figure 4 – Interview word cloud

Source: Devised by the authors

Figure 4 was obtained with Voyant Tools in the Cirrus tool and graphically reinforces some findings found in this study. Some terms deserve to be highlighted because they are directly associated with the objectives of this research: management, data, tool(s), information, time, control, capability, importantly, to optimize, vision and visual, balance, financial. These terms are linked to teacher(s), student(s), coordinators, course(s) (*gestão, dados, ferramenta(s), informações ou informação, tempo, controle, consigo e consegue, importante, otimizar, visão e visual, equilíbrio, financeira*). We also highlight the terms related to indicators: ENADE, enrollments, re-enrollments, class, graduates, attendance,

Moodle, dropouts, defaulters (*ENADE, matrículas, rematrículas, turma, concluintes, frequência, Moodle, evadidos, inadimplentes*).

Stage 2: Exploration of the material: In this stage, the central ideas were listed, it was intended to codify (highlight, classify, aggregate and categorize) excerpts from the transcribed interview, which we now present in table form (Table 2). In the category column, the three main themes of the interview were added:

1.   Assistance in the control and management of the course;
2.   Optimize management time;
3.   The listed indicators brought relevant information.

In the column Unit of Record are the text fragments that are taken as indicative of a characteristic (category). Finally, in the Context Unit column are the text fragments that encompass the recording unit and which, therefore, contextualize the respective recording unit during the interview.

Step 3: treatment of results, inference and interpretation: we present the main points and highlight the information relevant to the research objective, in addition to a reflective analysis.

Table 2 – Synoptic table

Category	Registration unit	Context unit
Assistance in the control and management of the course	Management	"super useful tool for management, before I had to search for data in several places and systems and also in a disorganized way..."; "I ended up doing corrective and not preventive management, now I can do a preventive analysis"; "...it only adds up, it only comes to improve the way we manage..., it ends up being a control tool, a lot of control" ; "tool to use in daily course management"; "it helps because you have an individual view of each student, it helps a lot"; "I have an overview and I know where I have to improve"; "The system has a broad view of the course that I don't have in SEGUE (academic system), in SEGUE it's very difficult to have a report... it's all ready, there's a report on everything, and then you can manage, because it's macro management for the micro, I don't need to go into 10 tabs and systems to solve something, it's all there"; "Being able to cross-reference these indicators are very important"; "
	Control	"I can look at the course as it is and I can make decisions and even make a plan with this data that is much more organized there"; "it is fully integrated with other HEI systems"; "the course is being monitored"; "I strongly defended the use of control tools, especially in remote environments"; "it was difficult to have control because before everything was spread out.... there was no way to have access to Moodle for teachers"; "we never had an instrument that we could see in one place only real academic information"; "the data in one place"; "I have an idea of the students who are and who are going to leave, which I was not able to do"; "very important visual and individual monitoring of the student, it is essential..."
Optimize coordinator management time	Optimize Time	"Real-time information"; "the largest possible amount of data for us to optimize our search time and to see where the coordination bottlenecks are" "allows us to optimize the control process"; "we used to waste time, right, there's no comparison when you open it and everything is in front of you, ready, visual"; "I used to do this research once a semester and look, now I'll have all the data in front of me"; "this type of program facilitated, gave dynamism"; "I didn't go after it because it was a lot of work" "this tool is agile"; "how are you going to optimize time, oh my God, time, time, time, because today is the thing that gets me the most... Optimizing time, today is one of the difficulties I have"
	Vision or visual	"very nice, very nice interface... I found this part of the intuitiveness to be a jewel, it's very easy to use, it couldn't be easier"; "it's all visual, you already look and it's all in front of you"; "its layout is very easy to use, any information is 2 clicks away"; "its layout is very simple..., it is very well distributed, also intuitive"; "In this system, I can have a vision of the student

		and the whole, this is very important..."; "very visual"; "it's great to see graphics"
The listed indicators brought relevant information	administrative and academic	"I am struck by the information on dropouts, those students who have not really re-enrolled themselves..., and you know this number, identified, knowing who it is"; "I can see that I have 17 students per class"; "this indicator guide is something that we never had within the management"; "student infrequency in Moodle I didn't have"; "students not renewed, this information we have now at the turn of the semester is very important"; "I can see the students who are going to leave..."; "correct enrollments, compare with defaults, this is very important to me, I didn't have access to default..." "ENADE indications, I saw that the agent improved, for me it was amazing to see that";
	Financial	"I didn't have this information before"; "there was only individualized information, I had to enter student by student and do calculations"; "super important information"; "super new"; "it is possible have a view of finance"; "...very important financial information, e.g.. student debt, defaulters..."; "I thought the recipe was cool, I like it, I thought it was cool that the default rate for my course is very low, and there are a lot of payers..."

Source: Devised by the authors (our translation)

The synoptic table (Table 2) presented above, built from the outlined objectives, the questions asked by the interviewer and excerpts from the interviewees' speech, leads us to the following data analysis:

1. Regarding "Aid in the control and management of the course", it is possible to perceive a significant number of positive inferences in Table 2, the coordinators showed how much the model helped them in their undergraduate course management routines, in addition to allowing them to centralize all the information considered important in one place, being able to visualize from the macro to the micro of the information. We emphasize that information, before the Academic Analytics model, was very difficult to obtain and most of the time it was not sought, due to lack of time and knowledge, thus, the model allows planning and constant monitoring, generating proactive management attitudes.

2. As for the second category "Optimizing the coordinator's management time", it is significantly recognized in the transcripts of the context unit of Table 2, the agility and time optimization for routine activities and course management are noticeable, the visual easy and integrated, with relevant information, saves time in the complex routine of an undergraduate course coordinator. We highlight an excerpt from an answer "*I used to do this research once a semester and look, now I will have all the data in front of me..., this type of program made it easier and gave dynamism..., I didn't go after it because it was a lot of work*" (our translation).

3. Regarding the perception if "The listed indicators brought relevant information", the interviewee did not ask directly, but what is inferred from the data is that the model allowed relevant analyzes that were not carried out by the coordinators, in this sense, the coordinators highlighted mainly the financial indicators, including non-paying students, to which they had no access, also highlighted the importance of having information about ENADE, non-renewed students, attendance, Moodle access information, teachers, among others. It is noticed again

that the model can help with relevant indicators to assist in the management process of the undergraduate course.

In relation to the suggestion for improvements, some information was listed that for some coordinators would be complementary, such as: an ENADE alert is also suggested when the student has 80% of the course completed, in this item we inform the coordinator that the indicator "graduates" already has this information. In addition, improvements were proposed that are CHEI processes such as: Management of students' complementary activities, a place to more easily insert complementary activities and Typing and archiving the minutes of meetings of the Structuring Teaching Nucleus and course collegiate, these suggestions were passed on to institution to analyze its processes.

It is also important to note that the coordinators did not report difficulties in using the system or errors, which shows the work of methodology, architecture, development and tests carried out in the Academic Analytics model.

Final considerations

Despite being a pilot experiment with partial results, which lead to new analyzes and improvements in the model, it is clear that the results are promising, especially with regard to time optimization and better quality in the visualization of relevant information, helping the management and control process of the undergraduate course. As a suggestion for future work to improve the model for an evaluation with more actors and over a longer period, thus generating more inputs for a more in-depth analysis of the importance of the Academic Analytics model for course coordinators. And, finally, as limitations of the study, the sample size of the respondents who contributed to this study is mentioned, as it is not possible to identify the universe of coordinators of the institution. As it is an exploratory study, it also has limitations and, for this reason, its results reveal the reality of a small group of coordinators of the investigated CHEI and not of its entirety.

REFERENCES

ARGENTA, C. A. L. **Gestão de instituições de ensino superior privadas e as competências necessárias aos coordenadores de curso**: desafios e sugestões. 2011. 193 f. Tese (Doutorado em Educação: Currículo) – Pontifícia Universidade Católica de São Paulo, São Paulo, 2011.

BARDIN, L. **Análise de conteúdo**. Trad. L. de A. Reto & A. Pinheiro. São Paulo: Edições 70. 2016.

BARNEVELD, A. V.; ARNOLD, K. E.; CAMPBELL, J. P. Analytics in Higher Education: Establishing a Common Language. **EDUCASE**, 2012. Available: https://library.educause.edu/resources/2012/1/analytics-in-higher-education-establishing-a-common-language. Access: 10 Apr. 2019.

BROKE, JOHN. SUS: A retrospective. **Journal of Usability Studies**, v. 8, p. 29-40, fev. 2013.

CAMPBELL, J.; OBLINGER, D. Academic Analytics. **Educause White Paper**, p. 1-24, 2007.

CAMPBELL, J.; DEBLOIS, P.; OBLINGER, D. Academic Analytics: A New Tool for a New Era. **Educause Review**, v. 42, p. 40-57, 2007.

CARDIM, P. A. G. Os caminhos percorridos na gestão educacional e as suas tendências. *In*: COLOMBO, S. S. *et al.* (org.). **Nos bastidores da educação brasileira**: a gestão vista por dentro. Porto Alegre, RS: Artmed, 2010.

CASTRO, A. Gestão financeira: a sustentabilidade financeira e a interação acadêmica nas instituições de ensino superior. *In*: COLOMBO, S. S. (org.). **Gestão Universitária os caminhos para a excelência**. Porto Alegre, RS: Penso, 2013.

FILATRO, A. **Data Science na educação**: presencial, a distância e corporativa. São Paulo: Saraiva Educação, 2021.

PAZ, F. J.; CAZELLA, S. C. Academic analytics: a systematic review of literature. **International Journal of Development Research**, v. 9, n. 11, p. 31710-31716, nov. 2019.

PAZ, F. J.; CAZELLA, S. C. Solução de Analítica Acadêmica focado em Instituições Comunitárias de Ensino Superior. **Informática na Educação: teoria & prática**, Porto Alegre, v. 23, n. 2, p. 195-215, maio/ago. 2020.

SIEMENS, G. Learning analytics: envisioning a research discipline and a domain of practice. *In*: INTERNATIONAL CONFERENCE ON LEARNING ANALYTICS AND KNOWLEDGE, 2., 2012, Vancouver. **Proceedings** […]. Vancouver, BC, Canada, 2012.

How to reference this article