EVALUATION OF BUSINESS INTELLIGENCE SOFTWARE FOR EDUCATION SYSTEM IN INDIA

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ABSTRACT- The use of Business Intelligence (BI) to increase academic performance and simplify administrative management is gaining traction in India's education system. Educational business intelligence software is advanced and well-organized. Training is highly important because it gives awareness and a healthy outlook to young minds. Though Business Intelligence (BI) is becoming increasingly common in developed countries, India is just getting started. This paper explains how BI software is used in schools and organisations to make administration work faster and simpler while minimizing manual labour. According to NASSCOM, India's BI industry is projected to hit USD 16 billion by 2025, accounting for 32 percent of the global BI market. Business intelligence software is a tool that simplifies the educational system by integrating different activities into a single system and delivering more knowledge to users. Analysing and designing new methods are used to clarify it. The use of business intelligence software has a positive impact on institutions and organisations. This paper analyses the evaluation and adoption of business intelligence software for education system in India.

Keywords: Business intelligence, Business intelligence software, Global BI market

I.   INTRODUCTION

Business intelligence (BI) is known for helping people make informed choices in several fields. With the help of reports, maps, ad-hoc queries, dashboards, and benchmarks, BI helps to better visualise results. Choosing the right BI tools for a business will lead to improved profit margins. **(Srivastava G et al. 2020).**BI software is used to make better choices and better utilise capital. It is very important in an organization's strategic planning process. Between 1970 and 1990, IBM and Siebel (now owned by Oracle) developed the first full business intelligence business intelligence software **(Venkatesh Umad et al.2012).**

Businesses vary based on the demands of new functions in different fields. According to their needs, new companies employ new roles. The program developed by Marlab, BI is common in the education sector because it reduces management complexity and costs. Every sector uses BI tools to evaluate their companies to make the best administrative decisions possible. Several issues can be resolved by changing procedures such as staff assignments and so on.

In the Indian market, the educational system is excellent. In the global economy, it may or may not be advantageous. Working with BI tools is a prerequisite for being a Business Intelligence leader, regardless of the industry. Software is needed to describe their data in a way that is understandable to the various types of employees on their payroll. IT firms are collaborating with educational institutions or energy companies. Different companies and organisations use Business Intelligence tools such as Tableau, Board, Domo, Qlikview, BI360, and Yellowfin to improve their academic performance and reduce management tension.

BI360 is a program that is used to boost efficiency to keep costs down and increase enrolment. "Solver's Microsoft-based BI360 software enables education administrators to integrate financial and student data through monitoring, roll-ups, budgeting, forecasting, modelling, dashboards, scorecards focused on key performance metrics, data warehousing, and data marts." Educators may use this app to carry out –

- A hybrid budgeting,

- The department manager and management are interested in goal-setting.

- Decide the sum of money required.

- Describe the enhancements.

- Work together to create a budget-related priority plan.

- Assess and track an organization's success.

- Improve administrative processes by lowering prices.

- High levels of transparency and satisfaction among students.

1.1 Building A More Efficient Education System with Bi Software

Educational institutions strive to make more money with fewer resources. The investment in school fees received, test outcomes, student body power, class size, average student attendance, and extended programs are all factors that influence school performance (Music, dance, fine art, sports, etc.). The organisations must be able to recruit potential students while still pleasing parents with their curriculum offerings and fee structures. The government is enforcing stringent controls on educational institutions and colleges. Using Business Intelligence software systems, all of the above data can be combined into a single framework, reducing the burden on human resources. Using business intelligence tools allows schools and universities to make quicker and more accurate decisions and provide academic reports. They easily achieve their objectives by analysing data with BI tools **James (2014). Hamid Mahroeian et al. 2021** conducted a study to see how higher education institutions in New Zealand value and use business intelligence to improve decision-making efficiency. "According to respondents, analytics enables better planning for student-related issues (e.g., enrolment, retention, and completion rate). Additionally, the study discovered various questions about institutions' ability to recognize the capacity and skills required to extract valuable information from publicly available data sets and convert that information into usable knowledge that can be used to assist students and educators. Also, respondents were worried that a lack of human resources and training to effectively use analytics could be detrimental. Others were worried that analytics could be used to spy on people and impose enforcement and regulation." Business intelligence (BI) is described as a system that combines data collection, storage, and management with analytical tools in order to provide planners and decision makers with complex internal and competitive data.

1. **Student learning outcomes and experiences**: The institution should examine the style of selection students prefer in subject selection as well as their success to redesign the schedule and subject preferences to increase exam results and student satisfaction. The students' success should always be measured against the government and institutional standards. Individual student evaluation is needed to consider each student's success in each subject and to help them progress by providing advice and coordinating corrective methods. Analysing students and offering additional help to obtain successful exam results. Analyse attendance statistics, incident reports, and disciplinary records to see how they behave.

2. **Administrative efficiency**: Control the amount spent on contract services and extracurricular activities and keeps track of it. Over time, monitor the number of students enrolled and size of the classes to determine resource planning and as per government funding.

3. For marketing purposes, student addresses are found. Information is readily available for government reports and funding requirements, as well as sector regulations.

4. **Workforce management and morale**: Ratio's student intake and appointing plans are determined essentially by taking student-teacher ratio into account. Adequate balance of teaching and teaching personal is also observed in the process. Observe the student administration process and assist with timetables and schedules. It's worth noting that teachers aren't given more lessons or work to do**James (2014)**

5. **Student's attendance-** In India, school and college dropout has always been big educational problem. In fact, according to recent statistics, approximately 52 percent of students drop out of elementary and primary school. This is important given that elementary and primary school education

accounts for approximately 39% of the overall education market. Since attendance and score data for students can be analysed to assess a student's lack of interest or declining persistence to come to school, business intelligence can be used in a big way to solve this problem, offering valuable insights into the cause and potential solution.

II.   LITERATURE REVIEW

What is the concept of business intelligence?

In 1989, Howard Drenser of the Gartner group coined the word "business intelligence." He started it to improve business decision-making by laying out a series of principles and approaches using computerised support and fact-based systems **(Nylund, A., 1999).**

Business intelligence, is a   management tool that helps companies direct and process business data (**Ghoshal& Kim, 1986).**

Business intelligence (BI) is described as a system that combines data collection, storage, and management with analytical tools in order to provide planners and decision makers with complex internal and competitive data**Negash(2004).** It's all about gathering, acquiring, knowing, analysing, and turning one of an organization's most valuable assets — raw data — into actionable knowledge in order to improve business performance **(Azvine, Cui, &Nauck, 2005).**

Business intelligence aims to capture data, information, and responses to business events so that they can be established further with quick and easy decisions. **(2009) (Guran, Mehanna, and Hussein).**

It is regarded as an analytical method that aids organizations/institutions in making better decisions about "revenue, market conditions, customer preferences, and product selections" **(Golfarelli, Rizzi, &Cella).**

Analysing and presenting information about a business with the assistance of critical business processes results in decisions and actions that contribute to the success of the business. Data that is unusable and useless is turned into valuable information and knowledge **(Williams & Williams, 2007).**

A person may perceive, infer, or shape opinions about the subject matter being researched with the assistance of the process of gathering high-quality and useful information **(Jonathan, 2000).**

According to StackoWiak et al. (2007), business intelligence is a mechanism by which massive amounts of data are analysed for creating complex database. This process results in sound business decisions by enabling management to make informed decisions.

BI is described by Zeng et al (2007) as "the process of collecting, analysing, and disseminating information to reduce unpredictability to make strategic decisions.

Business intelligence (BI), according to Ranjan (2008), is the strategic transformation of data from all sources into new forms in order to generate business-driven and result-oriented information**.**

BI is an "IT platform and resources used to collect, provide access to, and analyse data about organisational operations and activities." Business intelligence (BI) is defined as a strategy, technology, framework, methodology, or application for analysing a company's critical data and providing reliable and useful information to decision makers within a set time frame to aid decision-making (Gaolet al., 2020).

III.   METHODOLOGY

This page includes literature on business intelligence applications as well as data collected from secondary sources. The article describes business intelligence software and includes relevant literature and summaries in the context of BI software. The data gathered is then utilized to analyze the document.

The purpose of this article is to demonstrate a Pentaho software application in the setting of an educational institution. Among the many software options, Pentaho is a free program that offers a lot of flexibility in terms of researching BI resources and customization.

The data used in this study are composed of data related to the students and teachers of various institute campuses, from which personal information was collected in order to present only values without identifying their owners. Since the objective of this work is to present the application of educational data in the Pentaho suite, the data used meet this objective.

IV.   ANALYSIS AND INTERPRETATIONS

Employee morale and motivation may be boosted by BI software's simplicity and optimization of numerous critical procedures, while also making it simpler to manage the workforce as a whole. With the data and insights offered by business intelligence solutions, workforce planning, scheduling, and deployment may all be simplified. Finally, business intelligence software allows all teaching and non-teaching personnel to perform a better job, which enhances the students' educational experience. Furthermore, top-level management may measure and monitor the workloads of both teaching and non-teaching personnel to ensure that no one is overworked or underused. The usage of average grade-tracking capabilities that compare current performance to similar historical data may also be used to identify and act on student and instructor performance patterns.

4.1 Software

Pentaho Business Analytics is free software, and it has all of its open-source code for developing projects that use Business Intelligence. One of Pentaho's main differentials in relation to other BI software is the possibility of customization that it offers. The use of descriptor files in XML format allows change at runtime, making it easier to generate reports and more accurate information.

4.2 Reverse Engineering

As a starting point for carrying out the case study, a study of the database made available by the Institute was carried out. For this, a tool was used that would allow the realization of this reverse engineering and provide an overview of the existing data. The software used was SQL Manager for SQL Server 2008, which made it possible to view the database in an amplified way through a relationship diagram.

Figure 1 shows the diagram mounted with the selection of some of the tables. For the case study the tables were analysed: courses, scores, enrolment, institutions and teacher. Each of these tables has several fields that are used in the institute software, but for the study were selected only the fields necessary for the creation of cubes used.
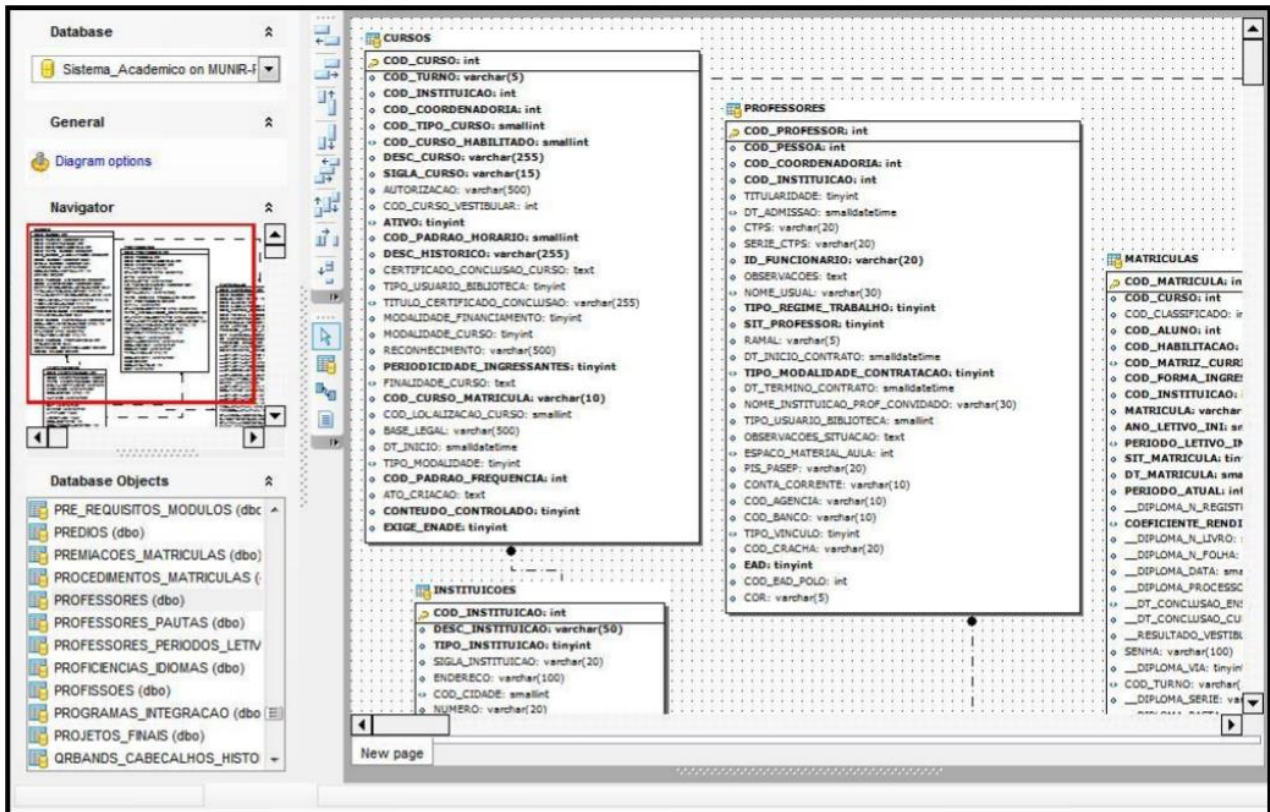
Figure 1 - Presentation of the SQL Manager

4.3 Cube Definition

After reverse engineering the operational database, the definition of the facts was made, dimensions and measures that would make up the cube would be developed for the use of multidimensional model. The database used was SQL Server, since the source database of the data provided by the Institute was also SQL Server. For the definition of the cube, it was necessary to answer a series of questions that according to Morales (2012) must be made before starting the creation of the multidimensional model. From this, the tables and relationships in the database were created.

The database and relationships were built using the multidimensional star model, which is the most often used for dimensional model construction and includes the establishment of a table of facts with the foreign keys of each primary key of the dimension tables, creating a star diagram.
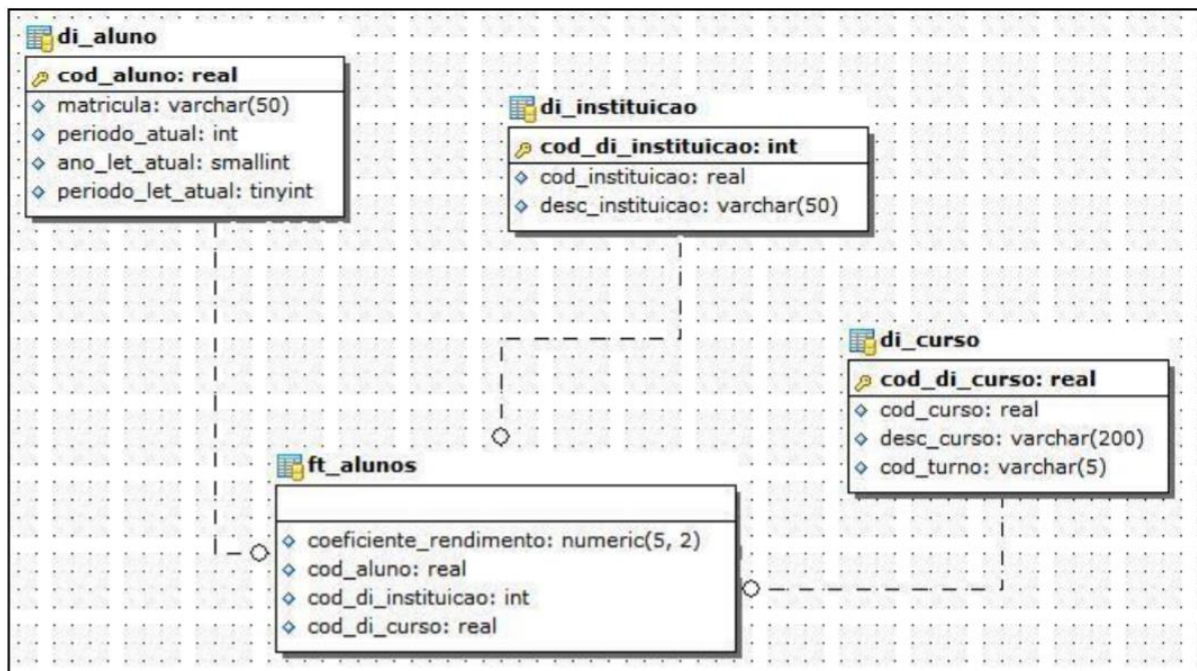
Figure 2 - Dimensions of the Aluno Fact

In the case study, two fact tables, Aluno, were created, containing the foreign keys: cod_aluno, cod_di_instituicao and cod_di_curso, in addition to the coeficiente_rendimento, which is the measure to be analyzed. Foreign keys are the primary keys of the respective dimension tables: di_aluno, di_instituicao and di_curso, as shown in Figure 2.

The fact table Professor was created containing the foreign keys: cod_professor, cod_pauta, cod_di_instituicao, besides the measure carga_hor_presencial, the measure to be analyzed in this fact. The foreign keys are the primary keys of the respective dimension tables: di_professor, di_pauta, di_instituicao, as can be seen in Figure 3.
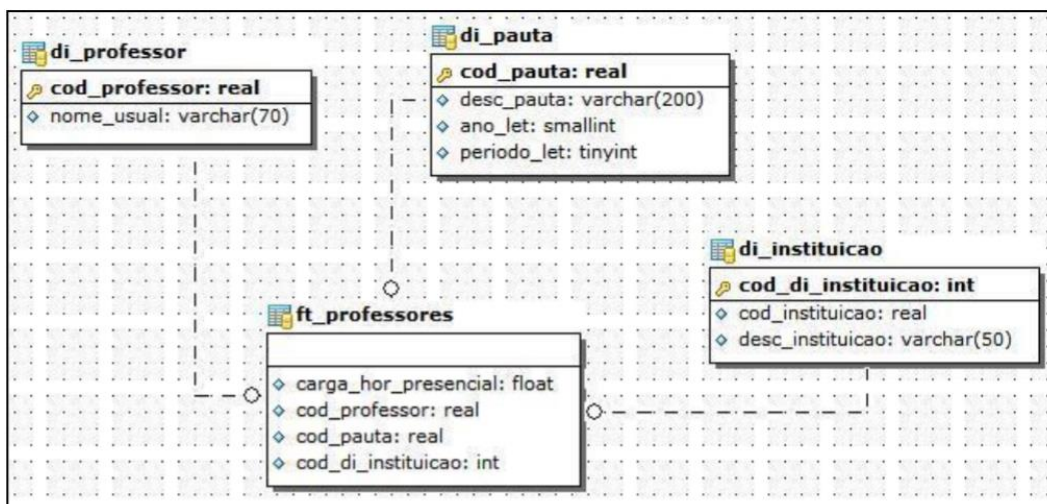

Figure 3 - Dimensions of the Professor Fact

4.4 Extract, Transform and Load (ETL)

The Extraction, Transformation and Load process was performed in one of the tools of the Pentaho suite, Data Integration, or Kettle. The tool provides the necessary support to perform all the tasks of this

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process. In the extraction stage, the data that would be used in the case study were selected from the database that was made available. Several fields have been extracted that can be used later, but only the previously defined fields will be used in the case study.

In the Load step, the values selected in the previous step are inserted into the desired table in the target database. For this, the connection to the target database has been created and selected a table where data will be inserted later. All the transformation performed in the di_curso table, presenting all the previously described items, is presented in Figure 4. This transformation is performed in all the previously defined dimensions and are very similar to this one presented.

The Transformation step is responsible for making a selection of the data that is useful for the study, creating fields that do not exist, but the business requirements so require, and performing calculations for the creation of these new fields. In this step you can also modify the ways of viewing the fields or rename them. "In the case study, some tables were transformed, such as di_curso and di_instituicao, because it was necessary te creation of a new field for the primary key, since the codes imported from the tables of the source database were duplicated due to the Data Warehouse concept that introduces fact table."
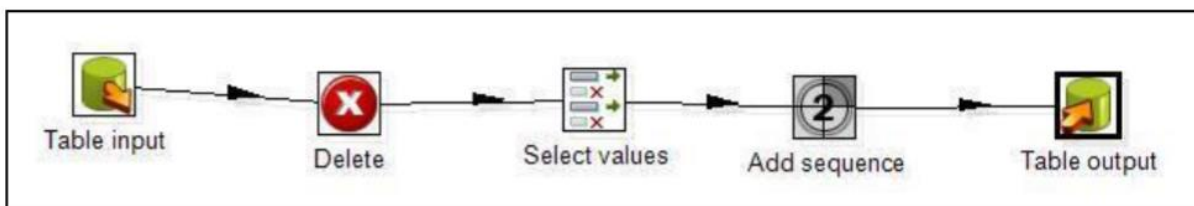

Figure 4 - Diagram of the transformation performed in the di_curso table

In the fact table the settings are different from those in the dimension tables, since this table is responsible for joining the information and relating it. For the ft_professores and ft_alunos tables, the settings were similar. Figure 5 shows the entire transformation performed on the ft_professores table.
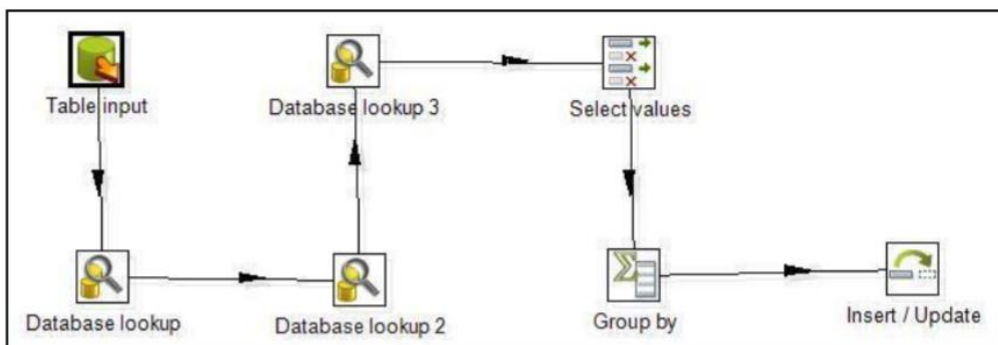

Figure 5 - Diagram of the transformation carried out in the table ft_professores

4.5 Pentaho User Console

After performing the previous steps, with the multidimensional database already created and populated with all the desired information, the next step was to use the Pentaho User Console to provide the information to the user. Figure 6 shows the initial screen of the tool. This screen shows the options to create a report and creation of an analytical view.
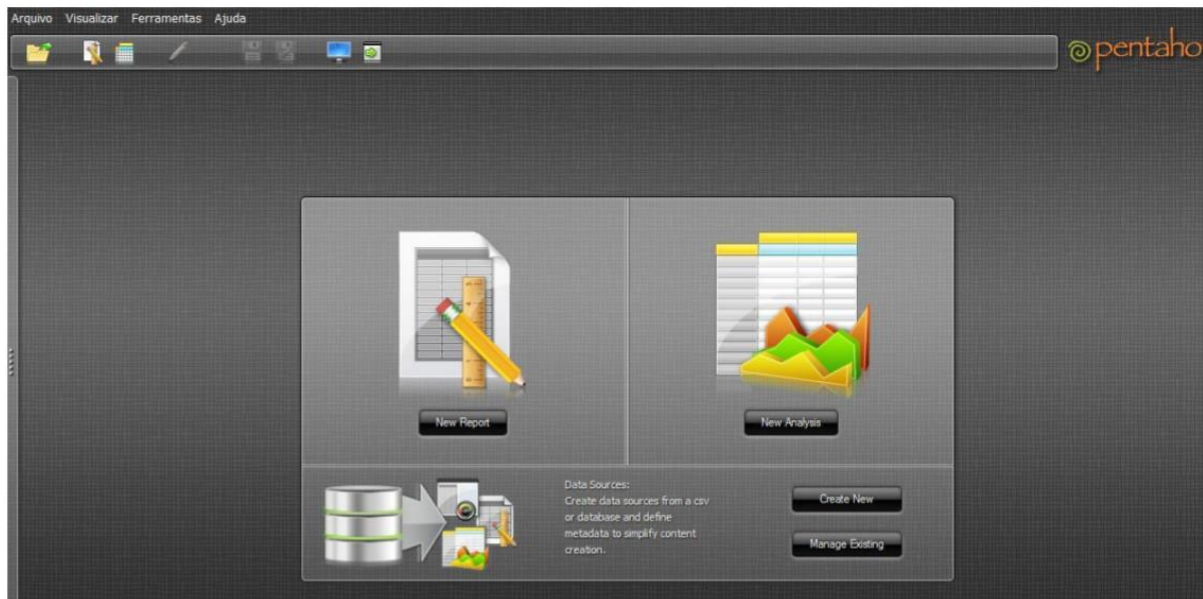
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Figure 6 - Presentation screen of the Pentaho User Console

To conclude the settings and make available for use, this step has been configured the connection with the database on the Pentaho Administration Console, so that the Pentaho BI Server could perform this connection. After this, two new data sources were created: one for the fact Professores and one for the fact Alunos. When creating the data sources, you need to insert an SQL consultation in order to define the fields and tables that you want to get. For this, Figure 7 presents the consultation performed for the fact Alunos.

```
SQL Query:
SELECT
C.COD_DI_CURSO,C.DESC_CURSO,C.COD_TURNO,I.COD_DI_INS
TITUICAO,I.DESC_INSTITUICAO,A.COD_ALUNO,A.MATRICULA,
A.PERIODO_ATUAL,A.ANO_LET_ATUAL,A.PERIODO_LET_ATUAL,
F.COEFICIENTE_RENDIMENTO
FROM DI_CURSO C, DI_INSTITUICAO I,DI_ALUNO
A,FT_ALUNOS F
WHERE F.COD_ALUNO = A.COD_ALUNO
AND F.COD_DI_CURSO = C.COD_DI_CURSO
AND F.COD_DI_INSTITUICAO = I.COD_DI_INSTITUICAO
AND F.COEFICIENTE_RENDIMENTO > 0
```

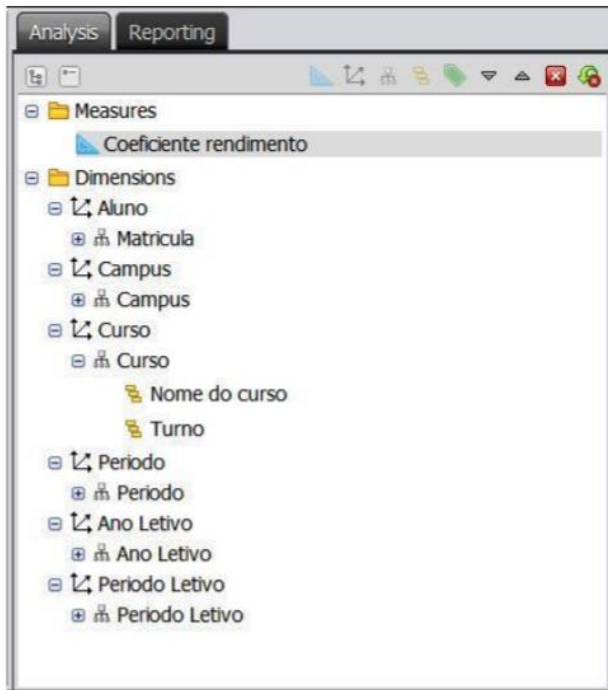*Figure 7. SQL consultation for the Alunos fact configuration*

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Figure 8: Fact Cube Configuration Alunos

Figure 9: Cube Alunos extending the students and campus dimensions

Once these settings have been made, the cube can already be viewed and manipulated. Figure 9 shows the cube with all the dimensions previously defined and the measure, the coefficient of efficiency. To do this, simply start a new analytical view and select the cube you want. It should be noted that the user does not perform the cube configurations, nor does it need to insert the SQL consultations, these creation and configuration tasks are left to the trained professional to perform them. This professional is responsible for performing all the steps described above and configuring the cubes and views according to the

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requests sent by the user. It is up to the user to simply request the information and views he wishes to obtain, and after the configuration made by the professional, he can have access to this information.

In this step, the user is able to extend the dimensions according to the analysis that he wants to perform. In addition, at runtime, it's possible to change the order of the columns in order to provide an analysis according to your need. Figure 10 shows the icons on the top left that the user must change to make changes to the columns. It is also possible to save the presented view with dimensions already extended in order to facilitate a new future consultation, providing greater agility and preventing execution errors. The icons located at the top are also allowed to change display settings for the displayed cube by changing the columns for rows and rows for columns. This setting is interesting for analytical purposes and visualizations desired by the user. You can also print the screen you are analyzing and export it to Excel. Another option allowed is the display of graphs, changed according to the expansion of the views.
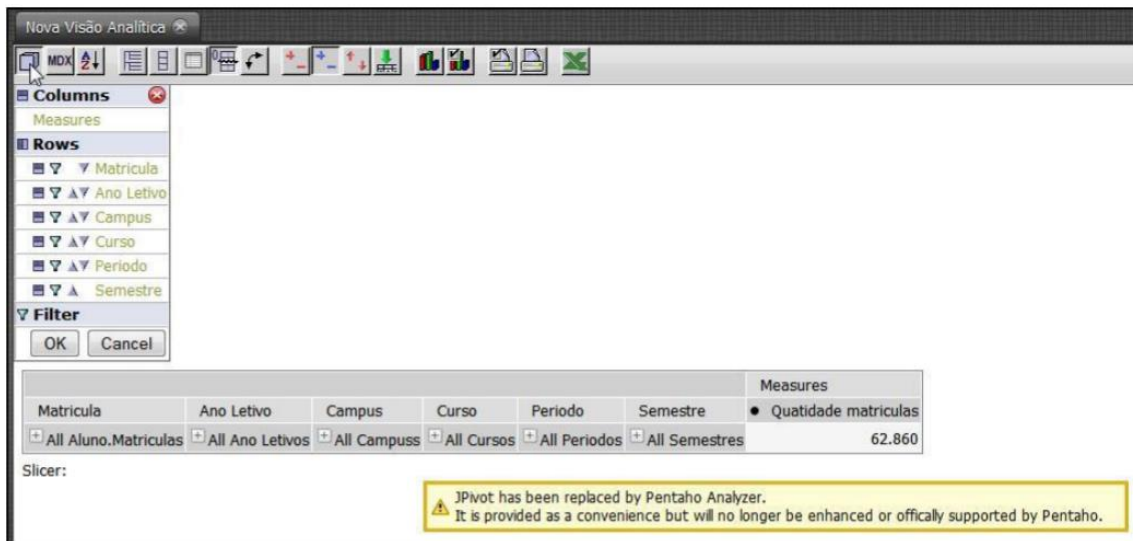

Figure 10. Cube Alunos screen, with configuration where user can change the order of the columns

The exploitation of such information gives the manager the possibility to visualize the data, which are often scattered in various software of the institution, in an organized and precise manner. This exhibition in multidimensional form is interesting, since it facilitates the search for information of a specific value, as of a wide value. In the case of the number of registrations, shown in Figure 10, it is possible to verify the quantity of both the entire institution, and of a group in one year and semester specifically. The facility in the exploitation of this information is a decisive factor for the decision-making of the managers in the right time and moment, making an important differential for the institution. Pentaho BI Server also offers simple and customized reports, choosing the file type of the exported report. The export options are: Excel spreadsheet, pdf file, csv file, and the option to just display on the screen, in HTML. Figure 11 shows a report exported in PDF, presented in the same software screen.

				Novembro 02, 2012 @ 01:59
VINICIUS	Campus Campos-c	20112.055.1V - Op ..	60	
VINICIUS TEIXEIR.	Campus Cabo Frio	PG01 - Trabalho e ..	32	
VITOR	Campus Campos-c	20112.037.3M - Inf ..	80	
VITOR	Campus Campos-c	20112.037.4M - Pla ..	60	
VITOR	Campus Campos-c	20112.037.4M - Pro..	20	
WALTER	Campus Campos-c	20112.050.4N - Cro..	60	
WALTER	Campus Campos-c	20112.050.4V - Cro..	60	
WALTER	Campus Campos-c	20112.103.5V.Qui ..	80	
WANDER	Campus Campos-c	20112.103.2N - Me ..	80	
WANDER	Campus Campos-c	20112.103.6N.Fis. -..	60	
WANDER	Campus Campos-c	20112.103.6N.Fis. -..	40	
WANDER	Campus Campos-c	20112.103.7V.Fis. -..	120	
WANDER	Campus Campos-c	20112.103.8N.Fis. -..	120	
WELLINGTON	Campus Campos-c	20112.043.1CN - C ..	40	
WILLIAM	Campus Campos-c	20112.116.6INT - C..	80	
WILLIAM	Campus Campos-c	20112.116.7INT - S..	80	
WILLIAM	Campus Itaperuna	20112.052.1N - Elet..	60	
WILLIAM	Campus Itaperuna	20112.057.2N - Elet..	60	
WILLIANS	Campus Itaperuna	20112.053.2M - Ed ..	40	
WILTON	Campus Campos-c	20112.046.3M - Rá ..	60	
WILTON	Campus Campos-c	20112.048.3N - Elet..	40	
WILTON	Campus Campos-c	20112.048.6N - Sist..	60	
				Ano Letivo: 2012

Periodo Letivo: 1

Nome Professor	Nome Campus	Nome Pauta	Carga Horaria
ADONIAS	Campus Cabo Frio	x	75
ADONIAS	Câmpus Campos -	20121.509.2ACU - ..	75
ADONIAS	Campus Campos-c	20121.043.1AN - S ..	40
ADONIAS	Campus Campos-c	20121.043.1BN - S ..	40
ADONIAS	Campus Campos-c	20121.151.1N - Sm ..	40
ADONIAS	Campus Campos-c	20121.151.6N - Se ..	40
ADONIAS	Campus Itaperuna	20121.918.2M - Se ..	75
ADONIAS	Campus Quissamã	20121.085.2INT - S ..	75
ADRIANA GUIMAR.	Campus Cabo Frio	CE01.04 - Inglês In ..	40
ADRIANA GUIMAR.	Campus Cabo Frio	CEV01.03 - Inglês I..	80
ADRIANA GUIMAR.	Campus Cabo Frio	CH01.01 - Lingua E..	80

Figure 11: A pdf report screen where you can save it.

V. DISCUSSION

The importance of collecting information and knowledge, as well as making good decision-making decisions, is emphasised by schools of thought. "In the field of game theory (Wilson, 1981), Influence and useless knowledge highlight the importance of data collection, as well as the organization's reputation and the ambitious advantages that come with it. He claims that coming across tainted information can be very emotional. A business intelligence analysis's regular access can be summarized as follows: the exploration's objectives are specified, and the execution pointers that will be used to rate various varieties are defined. Then, mathematical models are created, and analysis is performed to ascertain the effects on the settled performance. **(Vercellis,2009)."** As a result, distinct and collected knowledge from all fields is critical to improving the decision-making process.

VI. CONCLUSION

This paper aimed to conduct a literature review of research on business intelligence and education in India. Multiple avenues of BI interference have opened and will continue to open in India's education sector. Without harnessing this superpower, sometimes referred to as the new electricity for the twenty-first century, the nation will have to struggle to meet the targets set out in the SDG on Management of Quality Education. Business intelligence tools help businesses obtain actionable insights from their data to achieve their business objectives. Through providing businesses with reports from data centres, business intelligence solutions assist large organisations or institutions in analysing various combinations of data and performing complex calculations. Business intelligence is very useful for organisations that have a range of data sources and need to make informed decisions and process data. Although the concept of Business Intelligence is native to a business need, its use is not restricted to this area. On the contrary, Business Intelligence can be used in any environment where informed decision-making is necessary, as long as relevant, organized and reliable technology and data are available. Therefore, it is possible to develop new work investigating the effectiveness of the use of BI tools as an aid to management in other non-business environments. From the research carried out, it was possible to identify that the use of BI

and the Pentaho suite can be broadly expanded. The study concludes that once the institutions in India adopt the tool as a tool to aid decision-making can hold a large number of cubes settings and views so that they are available to managers and as the creation of new views is required, a scholar could attend these demands in a short time in order to generate more information to collaborate with strategic decisions.Overall, research into the use of business intelligence in the education system is still in its early stages, especially in the Indian context. This necessitates a change in the research community's attention to developing solutions that can solve the problems and mitigate the risks associated with the learning and research management systems in use in India. They must work efficiently while retaining high efficiency and management abilities. As a result, business intelligence solutions allow them to operate more rapidly and efficiently.

6.1 Future Research

It is important to understand the mindset of primary and secondary schools when evaluating the status of BI software in educational institutions. On new growth, the majority of BI software systems can endure substantial transformation. As a result, a brief analysis to gather feedback from organisations at different stages offers information on how to change and improve the current development image. There is also a shortage of empirical work on how to measure an organization's learning capability in terms of capacity development from BI software training. Future research can examine and test the principles and hypotheses underlying the software systems used in schools/institutions to improve academic performance and generate revenue at a low cost. Some of the expects that could be introspected involve the following 1) Evaluating the schedule and instructional architecture of business intelligence (BI) software systems.2) a labour shortage and an increased demand for data scientists' expertise; and3) comparing BI software systems from different countries (e.g., Germany, Australia, and India). (Y. R. Wang, 2014). It is imperative to acknowledge that quality BI software framework improves problem solving, teamwork, and helps schools to make better choices while maintaining good academic performance and management capabilities. (Wilder &Ozgur, 2015). The most pressing issue confronting academia is what it means to be an educatedindividual in the twenty-first century, as business intelligence can fundamentally alter the skill sets of the potential workforce, as well as its overall approach to work. (Jaggiet al., 2016)

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