

## **Utilisation of Business Intelligence in an Education Environment**

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The business intelligence is no longer only in the domain of business. Despite its name it can be vital for education institutions as well as for businesses. This article presents some views of business intelligence in education. First, there is mentioned the possibility to extend the traditional business intelligence, that is concerned mainly with sales and regions, of education component that would connect the performance to education and learning. Second, the use of business intelligence in universities is highlighted and some criteria for analysis using business intelligence tools are presented.

**Keywords** business intelligence; university; education

### **1. Introduction**

The utilisation of business intelligence (BI) in an Educational Environment can be seen from two different perspectives. It can mean the use of BI in commercial enterprises which fosters educational environment and seeks opportunities how BI can be useful or can complement to knowledge management activities or activities of learning organization. Second perspective is focused on the use of BI in education institutions and above all in universities. Both perspectives will be covered since they are very close and maybe invites for cooperation. However, only in the second perspective the particular organization will be targeted.

The BI solutions represent opportunities both for the businesses and also for the education institutions. In today's competitive and global world the universities have to behave like businesses. The need to act on the same ground as businesses is stress even more in small areas and in population that grows older. High mobility of students even in the whole European region and wide variety of educational institutions makes competing for students even more evident.

### **2. Business Intelligence**

Business intelligence stands for a wide variety of methods and technologies that managers use as a support for their decision making activities. Businesses started to implement BI methods and technologies to harness long investments into data processing technologies that amass data in large quantities. The enormous amounts of data required special kind of treatment to utilize them for decision making. The BI approach to data analysis enables to explore data from multiple dimensions and thus consider values from one dimension with respect to the context created by another dimension or with some found pattern from the data.

The figure 1 [1] presents a common components of a general BI solution. This general BI solution is focused on a traditional view of BI. The traditional view of BI is concerned with looking back on the data produced in primary processes. This view corresponds with business goals and needs to make processes efficient for which data/information driven decisions are important. In this view mostly the sales, region, product and time represents the most common dimensions. The major problem in this view is the determination of appropriate dimensions for the decision support activities.

There is however a second, broader view that not only encompasses the previous view but extends the BI of the educational component. The educational component connects the achieved results with learning activities that were undertaken. The educational component requires adding other dimensions to the analytical model. Incorporating the educational component into the BI solution will help the decision makers to create more accurate picture of the future development of the enterprise. The decision makers will have information not only about the past events but they will have better understanding of what knowledge supports certain levels of performance i.e. something which could prove useful in the future.

Incorporating education level to BI is also just what education institutions need to make BI useful in a learning environment. While BI in commercial enterprises offers answers to questions: What were the sales of product P in a region R for a time period T? This is of course vital for running the business and for managing the productivity of resources. However, what is often missing here is the question: What knowledge was necessary to achieve particular results and what knowledge was produced over such period of time? Basically, the mostly missing dimension of most BI implementation is the dimension of intelligence of workers that produce certain results.

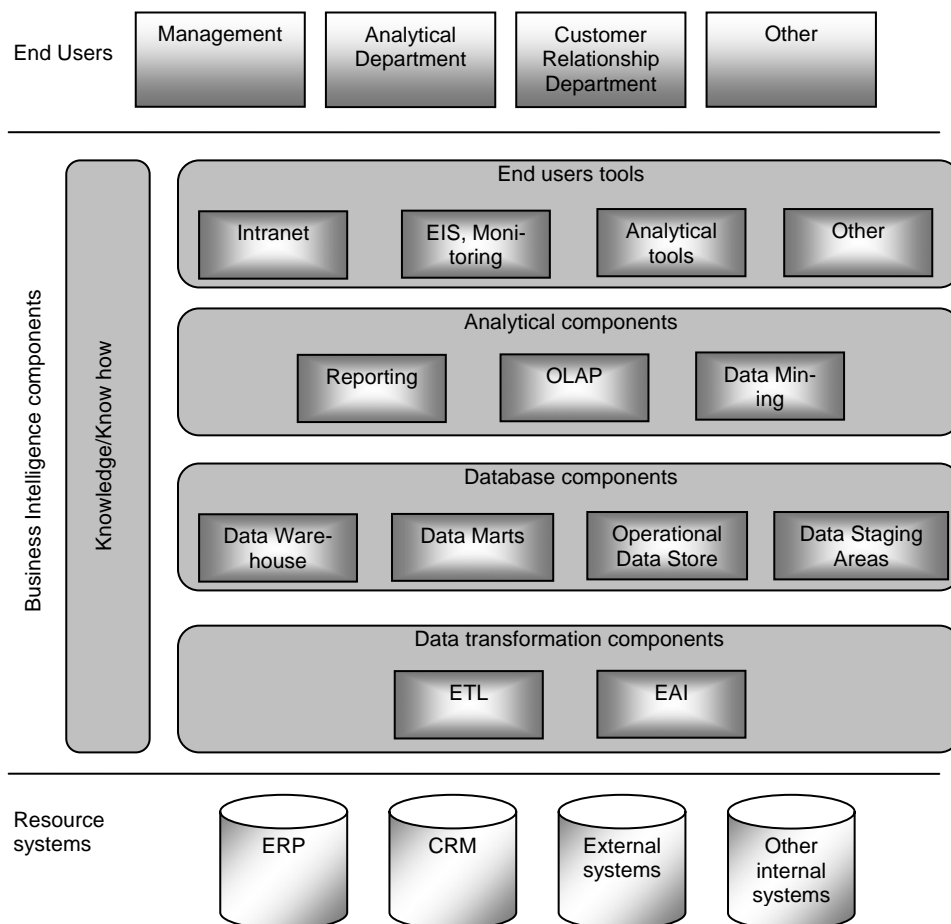


Fig. 1 Common components of a general BI solution.

Incorporating the education component requires to take into account or to create performance indicators that are based on the education trainings and materials available to the worker or in cases of educational institutions to students.

### **3. Business Intelligence in the Education Environment**

One of the tasks of managements of universities as well as other educational institutions is to assess how the university processes are going. For this purpose the BI methods and technologies might be vital. However, the major difference is that in the business environment the omnipresent hard metric of prices or amount is used. Such hard metric is not applicable for educational environment for most of the activities. In some cases also the hard metrics can be used in education (e.g. number of publications). One of the evident primary processes of the university is teaching. The difficulty is in the question, how to measure the success or failure of teaching activities or how to measure them at all. Hence the major task in implementing BI in the educational environment is to find an appropriate set of metrics that could be used for teaching and research activities.

Nowadays, in the Czech Republic the universities store data about the students' progress in an electronic way. Hence, there is no problem to do reporting of e.g. what is the number of students that pass the state exam this year, what are the students with all exams with grade A, etc.. Internally, the universities might create reports that show trends in numbers of students that completed successfully or finished unsuccessfully the studies; number of students applying for some specialization or subject; number of students actually enrolled in a particular school year, etc.

Preparing such reports and analyzing such trends enables universities to judge rising or falling interest of some specializations and might help to decide about the initiation of the process of accreditation of new specializations.

Similarly, the basis for decision making might stem from connecting internally gathered data with the external one. Connecting data about students with external sources is very useful, since it e.g. helps to analyze success of students on the labour market. For the university there might be very interesting to have access to data from the labour office. The BI solution might take data about the unemployment rates of some of the school graduates and link to specializations that they had studied. Such analysis serves for strategic planning of the university and also can be used for comparing the quality of education (and the success on the labour market respectively) in different educational institutions.

However, this is a question of having the data in an electronic way and linking them using some keys. A more difficult question will be to find out: What kind of support materials students have? What was the support of their learning? What is the percentage of students that participate in some research project? or even What is the kind of motivation used during the lessons? These will be dealt in the next section.

### **4. Our Approach**

The Faculty of Informatics and Management at the University of Hradec Kralove (FIM UHK) uses the approach in which first the metrics or performance indicators are set and then the BI method is applied. The metrics in focus of the FIM UHK can be divided into two groups along the two primary processes of the universities. These two primary processes are teaching and research. In teaching the intention is to find out how the quality of support materials affects the students results. In case of research the intention is to find out how active are the academic workers.

For research activities, there exist two subcategories: projects and publications. The particular metrics for the projects and publications are on FIM UHK as follows:

- Number of applications for local research projects
- Number of participations on local research projects
- Number of applications for international research projects
- Number of participations on international research projects

In cases of publications the metrics are as follows:

- Reviewed local conference proceedings
- Reviewed international conference proceedings
- Local conference proceedings without reviewing
- International conference proceedings without reviewing
- Publications in magazines with impact factor
- Publications in magazines without impact factor
- Publication of a book
- Publication of lecture notes
- Other publications

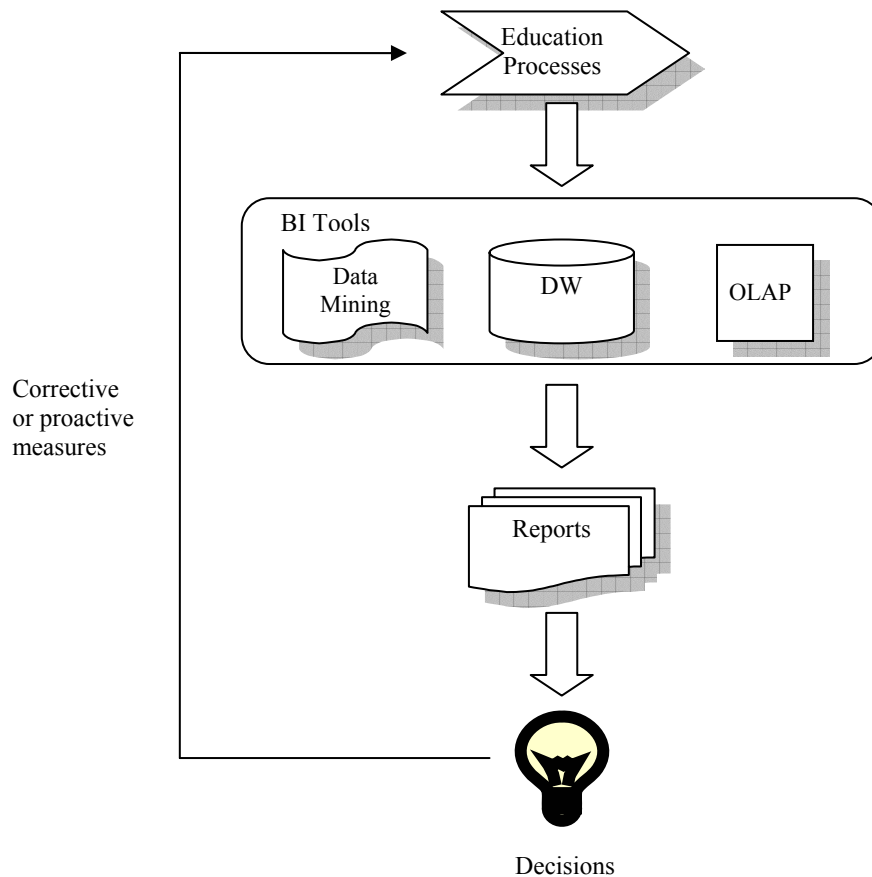
Since values from these criteria are by nature numeric, they can be easily used as facts in data warehouse data structures.

The criteria for the process of teaching are focused mainly on the education materials along various courses and the communication between the teacher and the students. The criteria are used to assess the motivation and the students' by-in into the subject. The criteria are as follows:

- Use of multimedia
- Inventiveness
- Attached resources
- Use of group projects
- Use of planning tools
- Use of communication tools
- Availability of self-tests and quizzes

The values of criteria used for assessing the teaching process are by nature mostly non-numeric, therefore there needs to be some normalization done prior to be used for analysis. The question of normalization is outside the scope of this article.

Once the criteria are composed they can be used for the decision support process in connection with BI tools. The decision process starts on the process level in which the education processes are in question. The values of proposed criteria are gathered and transported to the data warehouse so that to be used by the OLAP or data mining apparatus. Management obtain the results of the analysis in the form of reports on which managers would base their decisions. Such decisions will affect the scrutinized process so that to correct the unwanted behavior or to proactively change the behavior for better. In this way management of the university might react on the rising level of unemployed graduated students by preparing new specializations for which the labor market needs more workers. Similarly, management of the university might find correlations between the use of multimedia in teaching and the motivation of students to do self-test s and quizzes and as a result in better grades for such courses. The use of BI tools in education processes as proposed in FIM UHK are depicted in figure 2.



**Fig. 2** BI for education processes as being used in FIM UHK.

## 5. Conclusion

Current educational institutions and modern universities above all, have to foster their data and get any information or knowledge that can be utilised for better performance. The methods and principles of BI can be utilized in this way. BI in education environment can be viewed in many different ways. One way is concerned with the focus on education dimension as a component of the BI analysis in which questions about the educations and learning are put in context to traditional performance indicators. The second way of viewing BI in context of education environment is using BI for decision support of universities' managements. To use the BI in this way a set of appropriate metrics needs to be used. The FIM UHK prepares itself for the possibility to use BI by elaborating criteria that might be put in context with traditional student number indicators.

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## References

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