

INTRODUCING DATA VISUALIZATION TECHNIQUES IN COMPUTER INFORMATION SYSTEMS CURRICULUM

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ABSTRACT

Universities world-wide have incorporated Enterprise Resource Planning (ERP) systems into their curriculum to provide students with a better understanding of business process theory and concepts. In many of these universities, the SAP ERP software package is used where student focus is in entering transactions via the SAP GUI interface. Students typically become very good at data entry into an ERP system, however just like computer science majors who write programs that capture and store data, students never really see the big picture as to how this big data is ultimately used. Because data-visualization is both an art and a science [1], in which the goal is to communicate information clearly and efficiently using graphs, plots and charts, the authors have found that by complementing your course with Lumira, students are more able to clearly see the management side of big data. Therefore, this paper focuses on Lumira, a graphical analytical tool that allows users to drill deep down into data. Topics in this paper include a background on SAP and Lumira, and examples of how Lumira can be used in the Computer Information Systems (CIS) curriculum.

INTRODUCTION:

SAP, the world's largest and most well-known vendor of ERP software, created the University Alliances (UA) program to include their ERP software into university and college curricula. The UA program provides its members access to a full suite of SAP ERP software, "hands on" application software exercises, data center support, training seminars and educational resource materials. As a result, many universities have brought ERP training into their curriculum and have been using this for some time. SAP Lumira, a separate data visualization product debuted quite recently (2012) as SAP Visual Intelligence at the SAP TechEd conference. From the moment of its debut, it immediately caught the attention of the business intelligence community. Lumira's drag-and-drop interface enables users to "access, transform, and visualize data of any size in a repeatable and self-service manner" [2]. This is important because when used in the classroom, tools that utilize things such as drag and drop, have easy-to-perform visualizations, and are very intuitive, capture and keep the students attention longer [2]. This allows faculty to spend less time teaching software and more time having students think critically and exploring the data. Lumira does exactly this by emphasizing a simple user-friendly interface that provides a plethora of graphs and charts which can be created in seconds without the need for scripting. These include but are not limited to Column (Bar), Line, Pie, Area, Stacked, Dual

Axis, Combination, Donut, Scatter, Bubble, Tree Maps, Heat Maps, Geospatial Maps, Radar, Box Plots, Word Clouds, Waterfall, Parallel Coordinate, Funnel Charts and Grids [6].

Lumira is easy to use, in fact Berg [2] states that “training is really not needed”. Since implementing this in our computer information systems courses, we have found this to be true by simply monitoring student’s first use of the tool. For example, in an introductory information systems course, students were able to complete ten data visualizations within one hour and fifteen minutes without any prior experience with Lumira. With just a few clicks, data from multiple sources can be merged and visualized. This tends to make Lumira sound like it is not a powerful product; however, that is quite the opposite. Lumira’s capabilities include:

- Maximizing business knowledge by integrating wide-scale insights and drill-down to granular details
- Accelerating decision-making with immediate fact-based solutions to intricate business questions by avoiding list tables and fixed format reports. Interaction is key.
- Increasing self-service data usage without increasing the workload of the IT department
- Visualizing any amount of data in real time using SAP HANA and simple deployment to mobile devices [2]

In a typical university course using SAP ERP software, students focus on entering transactions via the SAP GUI interface and eventually become very good at data entry into an ERP system. And just like computer science majors who write programs that capture and store data, students never really see the big picture as to how this big data is ultimately used. By complementing your course with Lumira, students are able to see the management side of this by having the ability to answer questions that management is often faced with. For example, if asked the question “**What customers had purchases of over 5 million dollars with us?**”; we could use Lumira to visually produce the results as shown below (Figure 1):

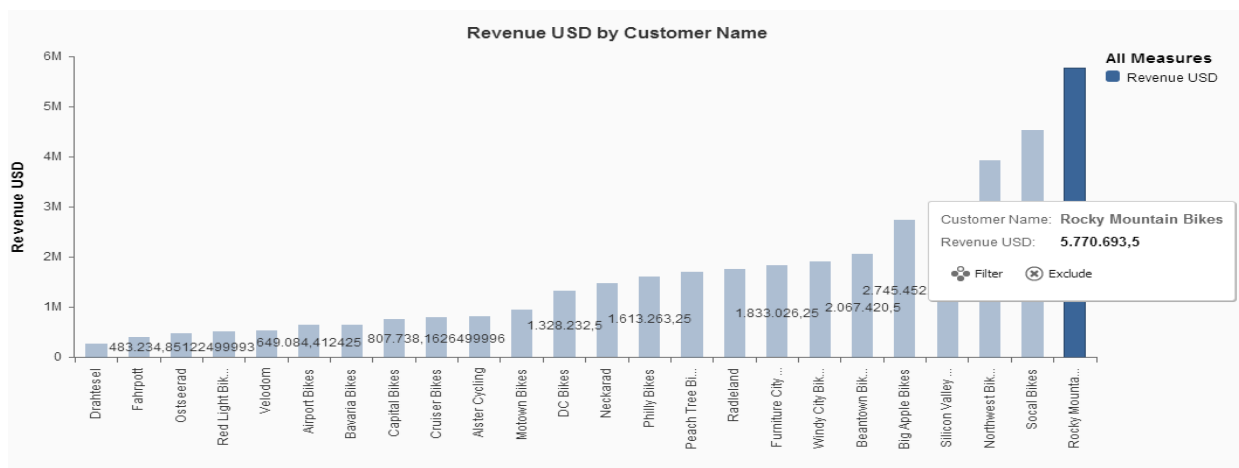


Figure 1. Bar Chart of Revenue by Customer Name

Because the human visual system has evolved over the years to become very good at recognizing patterns, data visualization has become a standard analytical tool. These tools capitalize on the ability of humans to recognize patterns produced when we introduce large quantities of information that have been generated by business information systems, and

particularly ERP systems. Many scientific studies [5] have led to the development of visualization models that utilize human perception and cognition.

SAP Lumira Cloud

For instructors, the real beauty of Lumira is that it is free, and cloud-based. SAP has provided Lumira in the cloud and has also provided datasets, exercises and student solutions based on results from their ERP simulator game as well as the GBI (Global Bikes) company ERP case study. The latter is important to note because many universities use the GBI dataset and SAP GUI interface to teach ERP, so this is a great complement to that. Besides the fact that Lumira is free to use, the major benefit is that there is neither hardware nor software to install on a student's PC and configuration issues are a thing of the past. Students just require a web browser and Internet access.

To begin using the Lumira system, a handout is provided to students instructing them how to setup an account within the system. Once that is done, students take the dataset provided by SAP and upload it into their personal account on Lumira. Next, students use the Visual tool features to create visualizations by simply dragging fields onto the user interface work area and choosing a visualization type. For illustration purposes, we have chosen to discuss the ERP simulator (ERPsim) exercise.

The ERPsim game is an ERP simulator played by student teams over several weeks that simulates a real business environment. They sell up to six products at a time from a possible 12 products that the market consumes. The products are all muesli cereal in various flavors and box sizes. The teams must forecast demand, run MRP (Material Requirements Planning), procure, produce, price and market their products for sale. The game is offered to members through the SAP University Alliance; however, SAP has provided Lumira users free access to the data (results) from a previously played game.

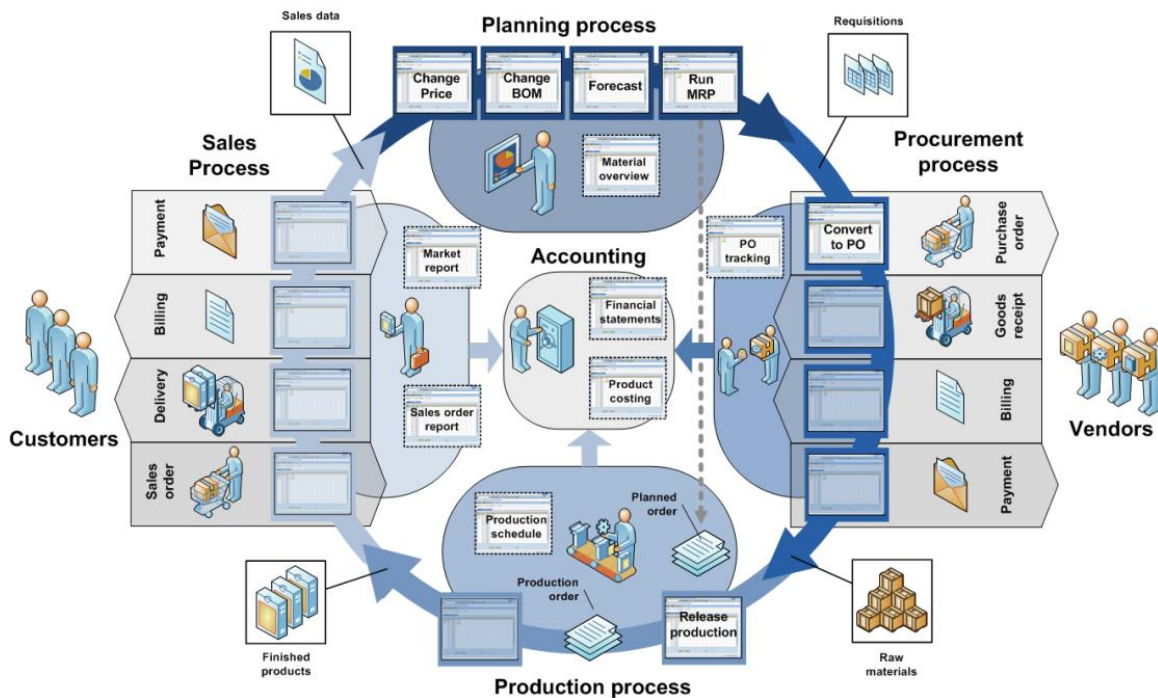


Figure 2. ERPsim Cash-to-cash Cycle

Figure 2 shows the entire cash to cash cycle in the ERPsim game. The transactions in bold are strategic decision points which teams must make and execute. The transactions that are gray are considered operational in nature and are automated by the simulator. Additionally, teams can run analytical reports at various points in the game to monitor and strategize [4].

Following the provided instructions, students are guided to <http://cloud.saplumira.com> where they will first setup an account for Lumira cloud to gain access to the system. This process takes only a few minutes. Next, students will upload the provided dataset to begin their exercise. After loading the data and following the instructions, they will begin their first exercise. The first thing presented to students is the following screen (Figure 3), which shows available values down the left side and available charts and graphs on the top right.

For the first exercise, the question is asked: **Which team had the highest revenue? What was the revenue?** But students are not left hanging at this point. Provided instructions give the following: **Hint:** Use a column chart. From Measures, drag Revenue into Y-Axis, from Dimensions, drag Team into X-Axis. In Y-axis (under Measures), click on settings, change Sort of revenue to descending.

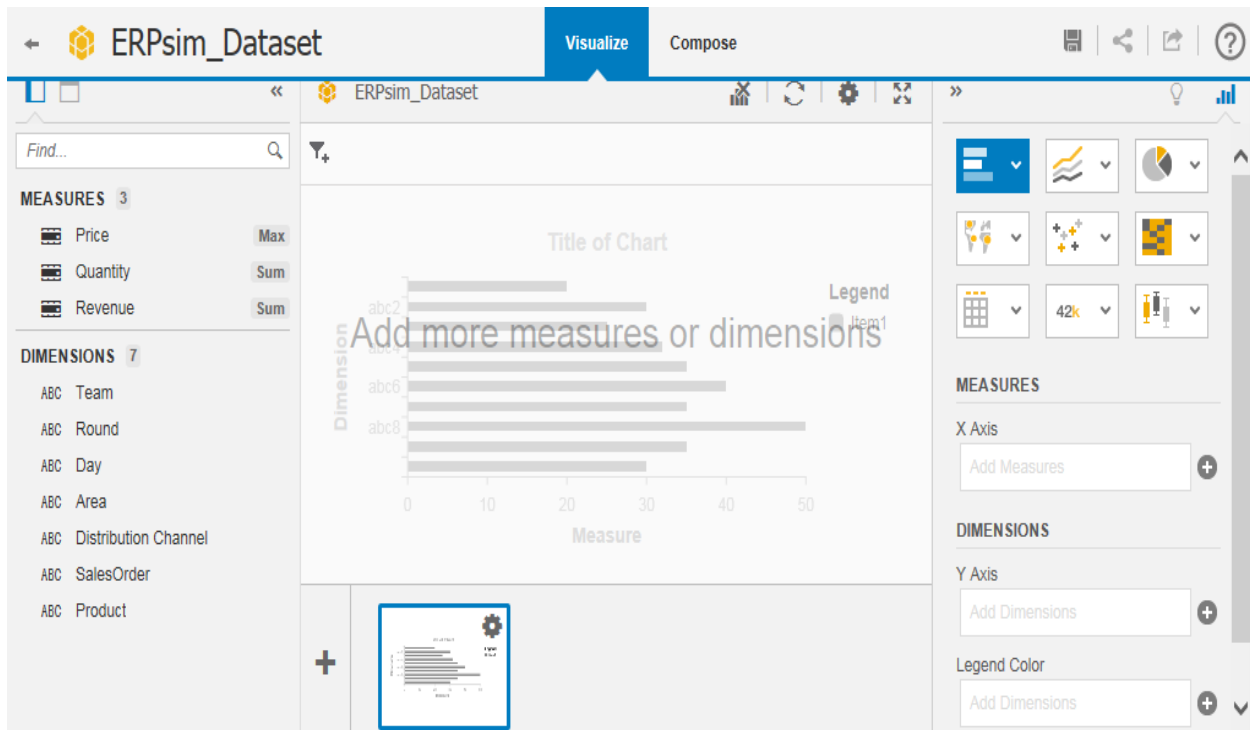


Figure 3. SAP Lumira Cloud GUI

If done correctly the following screen (Figure 4) is displayed.

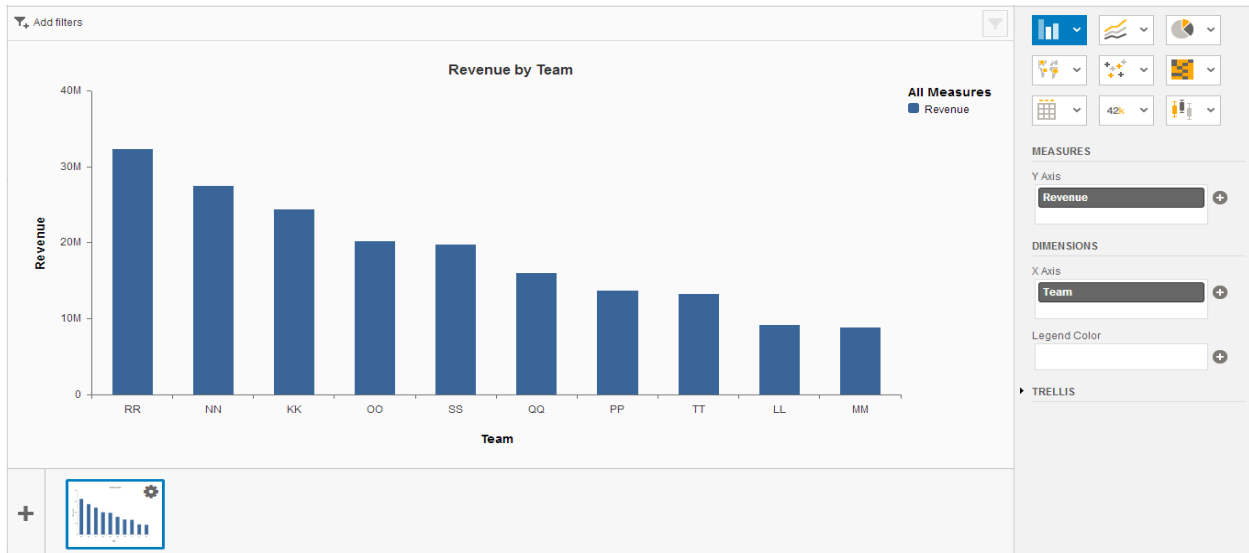


Figure 4. Lumira Bar Chart of Revenue by Team

Students are presented with this simple visualization and can hover over any of the bars to see the exact amount of revenue for each team.

The next assignment has the students **“Display the trend of revenue over rounds for each team”**. Again, a hint is provided: *Hint: Use a line chart. Y-Axis – Revenue, X-Axis – Round, Values & Color – Team. Sort the Round in ascending order (use arrows in the chart itself). In the legend for team, you can focus the analysis by selecting one of the teams (e.g. RR).*

Here students can begin to see the real power (Figure 5) of Lumira.

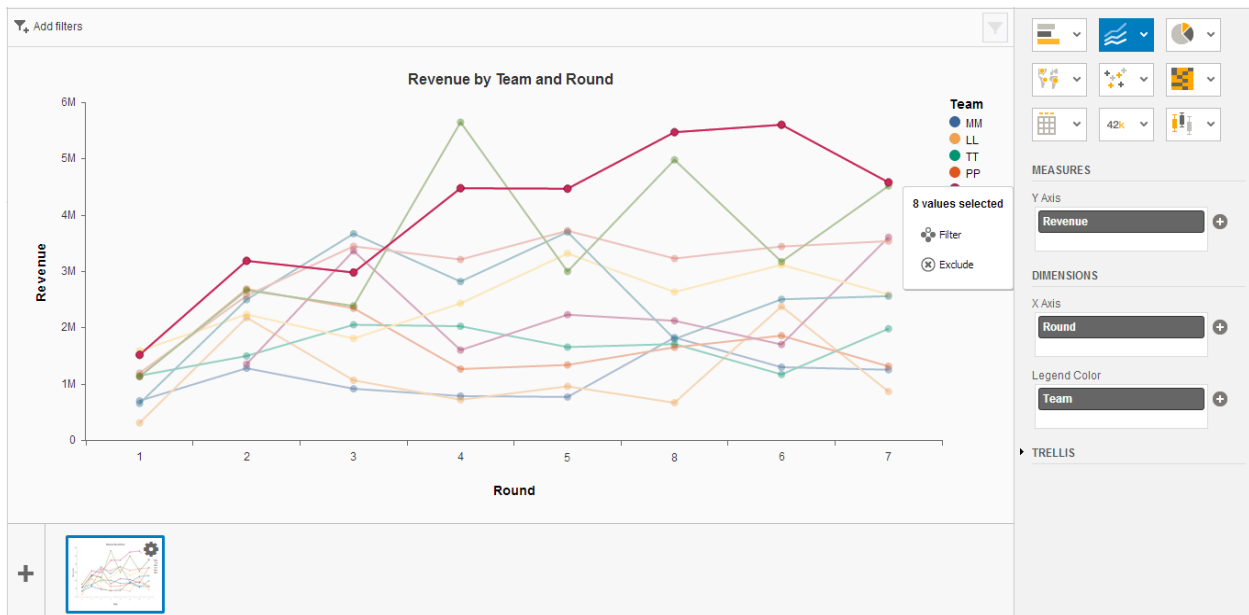


Figure 5. Lumira Line Chart of Revenue by Team and Round

There are ten exercises within the ERPsim instructions, all with hints. It is recommended that students first go through these on their own to obtain a good understanding of how the

system works. Next, as an instructor, you can come up with a number of additional exercises without hints. These could be used as either a graded item within your course, or optionally have the students post their results to a discussion board and then discuss the differences (there will be) and the steps they took to reach their results.

Conclusion: The Demand for Analytics

For a number of years now, we have all heard about “Big Data”, which is a broad term for data sets that are so large or so complex that traditional data processing applications are not able to easily handle analysis nor visualization. As a result of “Big Data”, the demand for analytics has grown exponentially [4]. Recognizing this, a number of American universities now offer data science programs. For example, Regis University offers a Master of Science in Data Science, the University of Washington offers an online Certificate in Data Science, Columbia University offers a Master of Science in Data Science, and the University of San Francisco offers both a Bachelor and Master of Science in Data Science and all have introduced Lumira into their curriculum.

SAP has also created the “SAP Lumira University Challenge”, where teams of students from around the world compete against each other. The Lumira competition requires students to research a global or societal problem, use public datasets to create visualizations that uncover trends, reveal patterns and insights effectively, and propose a solution on how to ‘help the world run better’ [6]. Students are judged on the best visualization, best big data entry, and best infographic. The Lumira challenge occurs once a year and is a great way to get students involved in learning about big data and the types of problems that can be solved with data science tools. Lumira also offers the Lumira BizViz Hackathon where programmers join teams of programmers in a competition to “create something unique and ‘wow’ the judges.”

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