



## School of Business and Economics

College of Professional Studies

### COURSE

DAB 370 - DATA VISUALIZATION AND COMMUNICATION

FALL 2018

### OVERVIEW

#### 1. To keep in mind

Instructor: Dr. Eduardo Rodriguez

E-mail: [Eduardo.Rodriguez@uwsp.edu](mailto:Eduardo.Rodriguez@uwsp.edu) I check my email regularly. This is the best way to get in touch. Please identify in the subject line of the email the course code DAB 370

Office: CPS 416

Office Hours Mo and Wed 11:00 – 12:00 and 1:00-1:30: PM

#### 2. Course Description

**Scope** This class teaches the main approaches to understand data, create and transfer knowledge using the most valuable and powerful system to identify patterns, relationships, outliers, etc. in data: Eyes and Brain. Our challenge will be to use different tools and concepts to develop the capacity to describe and explore data, understand the use of visualization for evaluating analytics work and transferring our analytics knowledge to our stakeholders. See the description of the course in the UWSP Catalog.

**Objective** The objective of this course is to study the methods used in data visualization to create knowledge usable to make decisions in a company's pursuit of its strategic goals and objectives. This course exposes students to several problems in the real world and the way to tackle them using data and its visualization. The outcome of visualization will be to support problem-solving (design and innovation) and decision-making processes leveraging analytics tools and our human senses.

The course aim is to provide students with an integrated study of the data and visualization techniques, and storytelling development in the context of a blend of business processes, analytics tools and practical applications to the business continuous improvement.



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In this course, the students will be able to design a data visualization roadmap. This roadmap will allow the understanding and use of visualization methods to add value to today's organizations.

### Mission

SBE Mission Statement: The UWSP School of Business & Economics educates and inspires students and prepares graduates for success in positions of leadership and responsibility. We serve the students, businesses, economy and people of the greater Central Wisconsin region. Our students achieve an understanding of regional opportunities that exist within the global economy. Evidence of our graduates' level of preparation will be found in their ability to:

- Analyze and solve business and economics problems
  - Understand the opportunities and consequences associated with globalization
  - Appreciate the importance of behaving professionally and ethically
- Communicate effectively.

### 3. Learning Objectives

#### What will you learn?

The Data Visualization course transports you to the world of the data representation, human comprehension and visual data discovery for creating value in organizations. Keep in mind the search for the answers to questions: What are the relationships among variables? What is a trend, gap, changes, etc., that we can observe from our data? How do we need to think about aesthetics, analytics models and communication at the same time for creating and using knowledge?

You will understand the use of analytics techniques to help people to connect their world perception and what data shows regarding several today's organizational/society problems. I recommend you to spend some spare time to watch some videos at <http://www.teradatauniversitynetwork.com/>

At the end of the course, you will

- Improve the capacity to identify patterns, relationships, outliers, and specific attributes of the data for a better use of analytics in organizations
- Understand, Apply and Integrate Core Management concepts to visual analytics and visual analytics to core management concepts.



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- Demonstrate Creativity, Problem-solving, and Decision Making Skills for using appropriate tools and concepts for data visualization
- Demonstrate the ability to perform different type of analysis under various business processes using data visualization
- Explore the use of data visualization methodologies for different problems: description, exploration, evaluation, classification, etc.
- Provide value to the business through the guide of visual analytics work according to the area of specialization and data available
- Develop a working knowledge base of terminology within the fields of data visualization and data modeling
- Explain the role of data visualization plays in efficiency and effectiveness of the whole analytics process
- Conduct and interpret visual analyses to support the business processes understanding and roads to actions
- Identify security, privacy, and ethical issues associated with operations management visual analytics
- Evaluate different tools, methodologies, and opportunities to use data visualization
- Develop the capacity to create, present and communicate a business story that includes results to several stakeholders in a simple, complete and clear way

### 4. Course Rules

Important academic aspects

**Attendance Policy:** You will be responsible for anything that goes on in class.

**Work turned in late:** Late work may not be accepted. If accepted, late work will lose 25% per calendar day.

**Missing Exams:** There will be no make-up exams. Students who have missed one of the midterm exams with a medical or university approved excuse, and who have notified me in advance will receive a statistically estimated score based on their other exams and project scores. For students who have missed more than one of the midterms or project reports, a zero will be used as the missing grade in the estimation of each



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missing exam. If you miss the final exam, you will receive a grade of zero for that exam.

**ADA Statement:** If you feel you may need an accommodation or special services for this class, please see me or call the service at 346-3365.

**Academic Misconduct:** Any student caught cheating or assisting another student to cheat or allowing another student to cheat may be removed from the class and given a failing grade. The minimum penalty for cheating is a reduction in points of 200% of the value of the assignment. Academic Misconduct is defined as violating provisions of Chapter UWSP 14, Rules of the Board of Regents of the University of Wisconsin System, Wisconsin Administrative Code.

<http://www.uwsp.edu/admin/stuaffairs/rights/rightsChap14.pdf>

**Technology Policy:** You may not have a laptop, tablet, cell phone or any other connected device out during class.

**Extra Credit:** Students may be given the opportunity to earn bonus points throughout the semester. I tend to put 105 points on a 100-point exam. The Project has bonus points for outstanding report and presentation. The extra points are extra credit. The availability of bonus points will be based on class pace, activities, and other circumstances. There is no guarantee that bonus points will be offered. When available, bonus point opportunities will be announced publicly in class or via D2L. No bonus point opportunities will be developed for individual students. That is, any request to earn bonus points by means of an activity that has not been publicized or offered to all enrolled students will be denied. Being absent from class automatically forfeits your right to earn the bonus points that were offered on the day you were gone. Exceptions for excused absences may be made at the instructor's discretion.

**Exam / Calculator / Cell Phone Policy:** You will need a calculator for the exams. It will need to be either a scientific or a business calculator (keys: [yx] or [^] and [ln] or [log]). You may NOT use an online calculator or a calculator on your phone, tablet, laptop, ... You may not share a calculator with another student. You may NOT have a cell phone out of your pocket/bag during an exam. Any student violating this policy will receive a score of zero (0) for the exam.

**Crib Sheet:** You are allowed a note sheet for each exam. This sheet may be up to 8.5 x 11 inches with notes on only one side. It may contain formulas, definitions, and notes on how to solve problems. It may not contain example problems, answers to problems or solved problems. It should have your name at the top. These crib sheets will be turned in with



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the exams. Any student using extra notes, or notes not allowed will receive a score of zero (0) for the exam.

### Plagiarism

Plagiarism is seriously taken as a form of stealing. Plagiarism happens when a writer uses the words or ideas of others as if they were his/her own words. It is often unintentional (hopefully), and can be easily avoided by always acknowledging the use of another's exact or paraphrased words/ideas with a proper citation of the source. Today's plagiarism detection software programs are extremely effective and widely used as a "stage one" screening device in the process of grading written assignments; detected plagiarism will result in an automatic "failing" grade for the course.

**SBE Events:** For this course, you must attend two official SBE Events. One event must be before the mid-semester cut-off of Fall 2017; a second event must be before the end-of-semester cut-off of Fall 2017. If you go to extra events before mid semester, those credits will carry over into the second half of the semester.

Visit the SBE Events web site (<http://business.uwsp.edu/events>) for announcements of upcoming SBE Events.

When you attend an event, it is your responsibility to sign in with your Point Card. Attendance at SBE Events will be confirmed with automatic emails to you and updated on the SBE Events web site. Please allow a week for confirmation of attendance at events held outside the SBE, such as Career Services events.

If you have multiple courses with SBE Events requirements, it is your responsibility to make sure you have attended enough events for each course. If you have not attended enough events to cover all of your courses, your attendance will be allocated to your courses in alpha-numeric order.

I will receive reports confirming your attendance. You do not need to do anything else. I will enter the SBE Event points into D2L once at the end of the semester.

### Grading

Grades may be curved from there at the discretion of the professor. If curved, they generally place roughly the top 25% of the students with a A



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or A- and roughly 75% of students with a A, A-, B+, B or B-. I will use whichever system gives students the higher grade.

Activity Points

Exam 1 100

Exam 2 100

Final project Part I 150

Final project Part 2 and presentation 150

Class participation 50

Total 550 points

Exam Coverage:

Exam 1: Topics covered first seven weeks

Exam 2: Topics covered weeks 8 -15

Final project all topics

	<b>Course Grade</b>	<b>Percentage Range</b>
Grading Scale	A	92.5% - 100.0%
	A-	89.5% - 92.4%
	B+	86.5% - 89.4%
	B	82.5% - 86.4%
	B-	79.5% - 82.4%
	C+	76.5% - 79.4%
	C	72.5% - 76.4%
	C-	69.5% - 72.4%
	D+	66.5% - 69.4%
	D	59.5% - 66.4%
F	0.0% - 59.4%	

**5. Project description**

1. Select a dataset that is interesting to you (Sets of data are available for several economic sectors and problems. They will be explained in class). You can select data because of the field of application (Healthcare, Natural Resources, etc.) or



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- because of the type of problem to solve (Search of relationships among variables, classification, etc.).
2. Your work is to present a report with the analysis of data using visualization techniques.
  3. You need to use at least five different types of visualization techniques.
  4. You need to explain what you observe with the data representations. Keep in mind some core ideas that you want to communicate.
  5. It is very important to create the report including a summary/dashboard that shows all the main points that you observed and the message that you want to transfer/share.
  6. Your report should be no more than ten pages

**6. Project evaluation**

Total points of the project including the final presentations 300.

Attribute of project	Points scale 1 to 5, 5 is better. Criteria to assign points
Use of computer based tools	Use of KNIME, PowerBI, Tableau, and R represents maximum value of 5
Organization of the ideas to communicate	Good description, order of the ideas, logic of the presentation of the ideas represent maximum score of 5
Presentation of the report document	Appropriate, accurate and complete document according to section 8 below will score 5
Variety of visual techniques used	5 or more techniques is the maximum value of 5
Design of visual results	The better aesthetic, selection, use, presentation of visual models in the report the higher the score with a maximum of 5





Bonus for extra work done in the project	Project with additional work done and excellent content and presentation can get up to 30 additional points
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### 7. Structure of the document for your project

You need to include in your project document the following points:

1. **Executive summary:** you need to say what you did, how you worked on the topic and what you found.
2. **Introduction:** a brief presentation of what you decided to review and the motivation for doing it. Indicate if you use some references to develop your project. You need to express in a clear way what you defined as questions to answer with your work.
3. **Methodology:** Explain what data you use, what techniques you use and why you selected them and how you interpret what you observed in your data.
4. **Results and analysis:** Present your visual representations, indicate what you observe and what you think the data is telling you.
5. **Conclusions and Summary:** Present in a graphic way the conclusions of your work. Create the dashboards or summary visual means to communicate your work.

### 8. Course Materials

Required text      • Notes of the professor

Software to use	<ul style="list-style-type: none"> <li>• KNIME Analytics Platform</li> <li>• R / R-Studio</li> <li>• Tableau</li> <li>• PowerBI embedded in Excel 2016</li> <li>• Other demonstrations from Teradata</li> </ul>
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Additional resources      Book1 Munzner T., 2014, Visualization Analysis and Design  
CRC Press  
Book 2 Wilkinson L., 2005, The Grammar of Graphics (Statistics and Computing), 2nd Edition, Springer  
Register for the Teradata University Network  
<http://www.teradatauniversitynetwork.com/>





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**9. Course Master Table**

Week	Session	Theory and problem in analytics to solve	Practice	Data literacy	Data Preparation	Data analysis	Data Communication	Data Governance	Influence	Team Participation	Curiosity	Problem Solving
<b>CASE NATURAL RESOURCES AND ENERGY</b>				x	x	x	x				x	x
03-Sep	Monday	Analytics Process and Visualization Process	Explanation projects, reviews, work with data, tools and interpretation	x	x	x	x				x	x
	Wednesday	Historical Perspective	Using KNIME for a complete analytics process/ where is visualization located in the work flow?	x	x	x	x				x	x
<b>CASE NATURAL RESOURCES AND ENERGY</b>				x	x	x	x				x	x
10-Sep	Monday	Visual analytics and Intuition	Readings Discussion - Tall D. 2014, Reading Rigour -Intuition Visualization	x	x	x	x				x	x
	Wednesday		Understanding principles of R	x	x	x	x				x	x
<b>CASE STOCK MARKETS</b>				x	x	x	x				x	x
17-Sep	Monday	Static to Dynamic to Virtual reality visualization	Where visual analytics is going to?	x	x	x	x				x	x
	Wednesday	Static to Dynamic to Virtual reality visualization	Understanding PowerBI/Tableau	x	x	x	x				x	x
<b>CASE STOCK MARKETS</b>				x	x	x	x				x	x
24-Sep	Monday	Representing Properties of Real World with Mathematics and Computation	Where visual Analytics is going to?	x	x	x	x				x	x
	Wednesday	Representing Properties of Real World with Mathematics and Computation	Using R some functions/capabilities	x	x	x	x				x	x
<b>CASE HEALTHCARE AND AIR POLLUTION</b>				x	x	x	x				x	x
01-Oct	Monday	Representing Properties of Real World with Mathematics and Computation	Thinking about visual data mining	x	x	x	x				x	x
	Wednesday	Representing Properties of Real World with Mathematics and Computation	Using R some functions/capabilities	x	x	x	x				x	x
<b>CASE HEALTH CARE</b>				x	x	x	x				x	x
08-Oct	Monday	Data, Knowledge Discovery, and Visualization		x	x	x	x				x	x
	Wednesday	Data, Knowledge Discovery, and Visualization	ggplot2 Diamonds example	x	x	x	x				x	x
<b>Review used data</b>				x	x	x	x				x	x
15-Oct	Monday	Studying Relationships Among Variables Using Graphics, Algebra, and Many Dimensions		x	x	x	x				x	x
	Wednesday		<b>Project Advance - Review - presentations</b>	x	x	x	x		x	x	x	x



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22-Oct	Review and evaluation			x	x	x	x					x	x
	Monday	Studying Relationships Among Variables Using Graphics, Algebra, and Many Dimensions		x	x	x	x					x	x
	Wednesday		Using R Tools R code - R cmdr and R rattle	x	x	x	x					x	x
29-Oct	CASE INSURANCE AND BANKING			x	x	x	x					x	x
	Monday	Analyzing more than three dimensions		x	x	x	x					x	x
	Wednesday	Analyzing more than three dimensions	Using R Tools R code - R cmdr and R rattle	x	x	x	x					x	x
05-Nov	CASE INSURANCE AND BANKING			x	x	x	x					x	x
	Monday	Analyzing more than three dimensions		x	x	x	x					x	x
	Wednesday	Analyzing more than three dimensions	Using R Tools R code - R cmdr and R rattle	x	x	x	x					x	x
12-Nov	CASE AIRLINES AND MARKETING			x	x	x	x					x	x
	Monday	From Frequencies to time		x	x	x	x					x	x
	Wednesday	From Frequencies to time	Using R Tools: example insurance R code, R cmdr and R Rattle	x	x	x	x					x	x
19-Nov	CASE KPIs AND KRIs			x	x	x	x					x	x
	Monday	Developing Meaning Creating Dashboards -Communicating our results/discoveries		x	x	x	x					x	x
	Wednesday		Project Advance - Review 2 Presentation	x	x	x	x		x	x		x	x
26-Nov	CASE TRANSPORTATION			x	x	x	x					x	x
	Monday	Big Data and visualization - Many records - Sensor data		x	x	x	x					x	x
	Wednesday		SaprklyR, Spark R - R Studio	x	x	x	x					x	x
03-Dec	CASE SOCIAL NETWORKS			x	x	x	x					x	x
	Monday	Big Data and visualization - Text and Social Media		x	x	x	x					x	x
	Wednesday		Q&A project - Guide to present final report	x	x	x	x					x	x
10-Dec	Monday	Course Review	Project presentation - Visualization Event	x	x	x	x		x	x		x	x
	Wednesday	Course Review	Project Presentation -Visualization Event	x	x	x	x		x	x		x	x
17-Dec	Submission final project												

**10. Course and syllabus revisions clause**

The instructor reserves the right to include additional content or to make other revisions to the course, schedule, or syllabus as necessary. These changes may occur at any time during the semester. Students will always be made aware of these changes via an in-class announcement, D2L post, email, or some combination of these.

**11. Student responsibility to know what is required**

Student performance will involve completion of the items listed in the “Grading” section. These tasks will be communicated to students in class, on the syllabus, on the course calendar, and/or on D2L. Please note, all items that appear on the syllabus/course calendar are expected to be



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completed on time, whether or not the instructor announces them in class. It is the students' responsibility to know what is required and where to look on the syllabus, course calendar, or D2L in order to locate the necessary information. If there are any questions, students are encouraged to email the instructor.

Students should check the syllabus/course calendar often so as to be aware of any changes. The "Last Updated" date is prominently displayed at the top of both of these documents. Comparing the date of your copy with that of the version available on D2L will show whether or not you are using the most recent draft. Some impromptu course points may be given without prior warning. If implemented, these impromptu points will not be stated on the syllabus/course calendar. As a rule, impromptu points, when implemented, will not constitute a significant percentage of a student's final grade (i.e.,  $\leq 10\%$  for each instance).

Unless approval is granted prior to being gone, there will be no make-ups for quizzes, in-class exercises, impromptu points, or assignments that are collected on a day that a student is absent. Students are responsible for all material covered in class and disseminated through other means, regardless of their presence in class when the information was taught. More information on absences is provided in the "Attendance" section below.

### 12. Participation

The key to having a great semester in this class is the informed, willing, and engaged participation of all students. You will ultimately learn more and the time spent in class will be more enjoyable if everyone participates fully. Be prepared to volunteer questions and reactions regarding information from the textbook chapters, supplementary readings, and ideas brought up during class. Successful participation is achieved through consistent, daily contribution to class discussion. Merely coming to class is not the same as participating. For this course, participation is not explicitly graded; however, it will be considered when evaluating close calls in final grades.

### 13. Classroom courtesy

**POSITIVE LEARNING ENVIRONMENT.** It is my goal to provide a safe and nurturing learning environment for all students. Therefore, breaches of classroom courtesy are defined as any behaviors that are disruptive to the learning environment. The following examples provide a foundational description of classroom courtesy:



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- Displaying respect for others is required at all times. It is not required that you share the perspectives of your classmates, but rather that you do not discredit their right to have their own opinion. Expressing alternate viewpoints is important, but this should be done in a collegial manner.
- Side discussions, listening to head phones, sleeping in class, and abusive language is considered disruptive behavior.
- No shouting, no profane language, no verbal or physical threats, no intimidation of any kind.
- Not arriving to class under the influence of any alcohol or drugs

### 14. Reviewing & disputing examinations

Students will not be permitted to retain their past exams or review their test booklets aside from the class time allotted for this purpose. It is forbidden for students to take photographs of their exams or the exam debriefing PowerPoints. Students caught doing so will receive a zero on the exam.

Students can petition the instructor via email to review their past exam outside of class. Permission for these special appointments is at the instructor's discretion. If an outside exam review session is granted, the student is only permitted to read through his or her own exam, without taking notes or highlighting the book or any other study materials. No electronic devices are allowed during outside exam review sessions. The last day that students can review past exams, even by special appointment, is listed on the course calendar.

Generally, disputes involving individual exam questions are not permitted due to the bonus point opportunities built into each exam to offset possible unfairness. If there are any remaining disputes of test questions, these appeals must be hand written and submitted to the instructor by the end of class on the day the exam is reviewed.

### 15. Class video recordings/photographs

At no time may a student (or the professor) take a photo, video, or audio recording in a regular class session without obtaining prior approval (written or verbal) from all individuals in attendance. The only exception is administrative documentation of the examination environment. That is, Exams may be video recorded or photographed by the instructor without prior consent from students. Recordings/photographs of exams will be taken for the sole purpose of resolving any possible disputes that may arise regarding exams or academic



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integrity. Exam recordings/photographs will never be shared publicly. Once the record maintenance period has expired, all exam recordings/photographs will be permanently erased.

### 16. Academic integrity

Academic dishonesty includes misrepresentations of facts regarding the timely completion of exams and papers. If it is determined that students have inappropriately collaborated on exams or assignment or that a student has used a classmates' responses to answer an exam question or complete an assignment, failing the course is the minimal likely appropriate sanction. Likewise, failure to properly cite sources used when completing a written assignment may lead to a failing grade on the paper or in the class. Students are expected to do their own work. If it is a group assignment equal contributions are expected. Asking another person for help if you are stuck is expected, but having someone do your work or copying another student's work is NOT permitted and is considered cheating. As a scholastic matter, it is at the discretion of the instructor to determine appropriate penalties. As a University disciplinary matter, academic dishonesty can result in suspension from the University or other lesser penalties. Any student involved in instances of academic dishonesty, intentionally or unintentionally, has failed to uphold the academic integrity of the university and is subject to penalty. Students will always be notified via email, without delay, if they incur a penalty of any kind.

The Student Rights and Responsibilities Document includes the university policies regarding academic misconduct, which can be found in Chapter 14. A direct link can be found here: <http://www.uwsp.edu/dos/Pages/Academic-Misconduct.aspx>.

UWS 14.03 defines academic misconduct as follows: Academic misconduct is an act in which a student:

- seeks to claim credit for the work or efforts of another without authorization or citation;
- uses unauthorized materials or fabricated data in any academic exercise;
- forges or falsifies academic documents or records;
- intentionally impedes or damages the academic work of others;
- engages in conduct aimed at making false representation of a student's academic performance;
- assists other students in any of these acts.

In terms of plagiarism, please note that you must reference all sources in the body of submitted papers and on a complete reference page. Source information must be provided regardless if you are quoting or paraphrasing. The rule of thumb is anything not common knowledge must be referenced. Failure to do so will result in a failing grade or a lesser grade penalty. Be aware that



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UWSP subscribes to Turnitin™, a plagiarism detection service, and all cases of plagiarism will be identified. Instances of plagiarism will

result in course-level consequences as well as a university disciplinary case. Using the work from another student or students from past classes is not appropriate and is considered plagiarism. Information on non-academic misconduct can be found in Chapters 17 and 18 of the Student Rights and Responsibilities Document. A link to the university's policies on non-academic misconduct can be found at <http://www.uwsp.edu/dos/Pages/Information%20for%20Students.aspx>.