INFORMATION SYSTEMS EDUCATION JOURNAL

Volume 24, No. 6
November 2026
ISSN: 1545-679X

Special Issue: Artificial Intelligence and Pedagogical Innovation

4. **Introduction to the Special Issue on Artificial Intelligence and Pedagogical Innovation**
Eric Breimer, Special Issue Guest Editor, Siena University
Kevin Mentzer, Nichols College
Ira Goldstein, Siena University
David Yates, Bentley University
Michelle Louch, University of Pittsburgh Greensburg
Mark Pisano, Southern Connecticut University

7. **Comparing Augmented Generative AI Platforms and Programming-Based Tools for Teaching Data Analytics to Undergraduate Business Students**
Wenqi Zhou, Duquesne University
Pinar Ozturk, Duquesne University
Kathleen S. Hartzel, Duquesne University
Carlos Salazar-Betancourt, University of Rhode Island

21. **Integrating Artificial Intelligence into Undergraduate Business Programs: An Analysis of AACSB-Accredited Schools**
Kiku Jones, Quinnipiac University
Lori Leonard, University of Tulsa
Wendy Ceccucci, Quinnipiac University
Guido Lang, Quinnipiac University

31. ***Teaching Case***
Developing Critical Thinking in Data Analytics Education: A Teaching Case Evaluating ChatGPT Responses to a Visualization
Benjamin Larson, Auburn University of Montgomery
Jeffrey Bohler, Auburn University of Montgomery
Nandini Bolekar, Auburn University of Montgomery

44. ***Teaching Activity***
Introducing Data Analytics and AI Collaboration to Novice Students: An Assignment Using Real Business Data
Thilini Ariyachandra, Xavier University

63. **Teaching with Generative AI: Ethics and Analytical Confidence in Undergraduate IS Education**
Asish Satpathy, Arizona State University
Jayaram Balachander, Arizona State University

75. ***Invited Article***
Designing for Tension: Balancing the Pace of Trust and the Pace of Innovation in AI-Integrated Higher Education
David Firth, University of Montana
Jason Triche, University of Montana
Isho Tama-Sweet, University of Montana

iscap
Information Systems & Computing Academic Professionals

The **Information Systems Education Journal** (ISEDJ) is a double-blind peer-reviewed academic journal published by **ISCAP** (Information Systems and Computing Academic Professionals). Publishing frequency is five times per year. The first year of publication was 2003.

ISEDJ is published online (https://isedj.org). Our sister publication, the Proceedings of the ISCAP Conference (https://iscap.us/proceedings) features all papers, abstracts, panels, workshops, and presentations from the conference.

The journal acceptance review process involves a minimum of three double-blind peer reviews, where both the reviewer is not aware of the identities of the authors and the authors are not aware of the identities of the reviewers. The initial reviews happen before the ISCAP conference. All papers, whether award-winners or not, are invited to resubmit for journal consideration after applying feedback from the Conference presentation. Award winning papers are assured of a publication slot; however, all re-submitted papers including award winners are subjected to a second round of three blind peer reviews to improve quality and make final accept/reject decisions. Those papers that are deemed of sufficient quality are accepted for publication in the ISEDJ journal. Currently the target acceptance rate for the journal is under 35%.

Information Systems Education Journal is pleased to be listed in the Cabell's Directory of Publishing Opportunities in Educational Technology and Library Science, in both the electronic and printed editions. Questions should be addressed to the editor at editor@isedj.org or the publisher at publisher@isedj.org. Special thanks to volunteer members of ISCAP who perform the editorial and review processes for ISEDJ.

2026 ISCAP Board of Directors

Amy Connolly
James Madison University
President

Michael Smith
Georgia Institute of Technology
Vice President

Jeff Cummings
Univ of NC Wilmington
Past President

David Firth
University of Montana
Director

Mark Frydenberg
Bentley University
Director/Secretary

Leigh Mutchler
James Madison University
Director

RJ Podeschi
Millikin University
Director/Treasurer

Bryan Reinicke
Rochester Institute of Technology / Director

Jeffry Babb
West Texas A&M University
Director/Curricular Matters

Eric Breimer
Siena University
Director/2026 Conf Chair

Thomas Janicki
Univ of NC Wilmington
Director/Meeting Planner

Xihui "Paul" Zhang
University of North Alabama
Director/JISE Editor

Copyright © 2026 by Information Systems and Computing Academic Professionals (ISCAP). Permission to make digital or hard copies of all or part of this journal for personal or classroom use is granted without fee provided that the copies are not made or distributed for profit or commercial use. All copies must bear this notice and full citation. Permission from the Editor is required to post to servers, redistribute to lists, or utilize in a for-profit or commercial use. Permission requests should be sent to Kevin Mentzer, Editor, editor@isedj.org.

INFORMATION SYSTEMS EDUCATION JOURNAL

Editors

Kevin Mentzer
Editor
Nichols College

Ira Goldman
Associate Editor
Siena University

David Yates
Associate Editor
Bentley University

Michelle Louch
Teaching Cases & Exercises
Editor
University of Pittsburgh - Greensburg

Mark Pisano
Teaching Cases & Exercises
Associate Editor
Southern Connecticut
State University

Thomas Janicki
Publisher
Univ of NC Wilmington

David Woods
Assistant Publisher
Miami University
Regionals

Paul Witman
Emeritus Editor
(2021-2026)
California Lutheran
University

Jeffry Babb
Emeritus Editor
(2016-2021)
West Texas A&M
University

Donald Colton
Emeritus Editor
(2003-2010)
Brigham Young University
Hawaii

Teaching Case

Developing Critical Thinking in Data Analytics Education: A Teaching Case Evaluating ChatGPT Responses to a Visualization

Benjamin Larson
blarson@aum.edu

Jeffrey Bohler
jbohler1@aum.edu

Nandini Bolekar
nbolekar@aum.edu

Auburn University at Montgomery
Montgomery, AL, 36117, USA

Hook

Can you trust what AI tells you? This case challenges students to analyze AI outputs and develop critical thinking in data-driven decision-making.

Abstract

Data analytics education increasingly incorporates generative AI tools, yet AI output can be inconsistent or misleading. This teaching case develops critical thinking by challenging students to evaluate AI-generated interpretations of data visualizations through Robert Ennis' three dimensions: logical, criterial, and pragmatic. Using a wage-by-tenure visualization that subtly violates linear regression assumptions, students prompt ChatGPT with structured queries, assess responses, and refine their prompts while engaging in peer reflection. The case targets the Data Understanding phase of CRISP-DM, where students must determine whether relationships are linear or require feature engineering. Structured rubrics guide assessment of prompt engineering and reasoning. Designed for undergraduate analytics, MIS, and statistics courses (adaptable to graduate programs), this case prepares students for AI-augmented workplaces by strengthening both technical skills and professional judgment in evaluating AI outputs. Supporting materials include complete datasets, sample deliverables, and validated implementation guides.

Keywords: Critical Thinking, Generative AI in teaching, Data Analytics, Data Visualization, Prompt Engineering, CRISP-DM

Recommended Citation: Larson, B.E., Bohler, J.A., Bolekar, N., (2026). Developing Critical Thinking in Data Analytics Education: A Teaching Case Evaluating ChatGPT Responses to a Visualization. *Information Systems Education Journal*, v24(n6) pp 31-43. DOI# https://doi.org/10.62273/RLDU1198

Developing Critical Thinking in Data Analytics Education: A Teaching Case Evaluating ChatGPT Responses to a Visualization

Benjamin Larson, Jeffrey Bohler, Nandini Bolekar

1. INTRODUCTION

Data-driven decision-making is essential for modern businesses and requires a wide range of technical skills (Collier & Powell, 2024). Connecting details to higher-level concepts requires education and practice (Holmes, Bialik, & Fadel, 2019). However, there is a shift towards low- and no-code solutions that enable a wider range of students to tackle more technical challenges, such as machine learning (Sundberg & Holmström, 2024). Generative AI is making many complex processes more straightforward, and we may see a future in which most code and programs are generated from prompts using natural language and multimodal inputs such as images, audio, and video. If this is the case, an emphasis on critical thinking and problem-solving is needed when using AI (Kasneci et al., 2023). Akhtar (2025) and many others argue that careers are less likely to be replaced by AI itself, but rather by individuals who effectively leverage AI tools, in other words, AI literate. This highlights the importance of exposure to AI while enhancing "people" skills (Gonzalez, 2023). Ultimately, generative AI can serve as a critical component in scaffolding, enabling students to tackle complex problems. This case allows students to improve their critical thinking skills by applying scaffolding to the Data Exploration step of the Data Understanding phase of the CRISP-DM framework. However, students still need to evaluate AI responses for relevance and accuracy.

2. CASE AS A PART OF A LARGER PROJECT

The assignment described here is part of a much larger semester project. The semester project is intended to use most or all of the CRISP-DM model and complete many of its tasks (Table 1). This assignment is designed to provide scaffolding for the data understanding phase, specifically to support data exploration. The overall goal of the semester-long project is to create a model that will allow Widgets Inc to control for and statistically evaluate wage fairness. It would be appropriate to provide students with portions of the Business Understanding Phase to help them understand the problem if this phase and its tasks have not been completed earlier (Appendix A). The students may also be asked to generate the graph evaluated in the assignment, using the sample data provided in Appendix B and the complete data set available upon request. The assignment involves evaluating one scatter plot; an example is provided in Appendix C. As this assignment is intended to be performed during data understanding or preparation, additional slides and materials are available to supplement those phases.

CRISP-DM Phase	Tasks	Weeks
Business Understanding	Determine Objectives, Assess Situation, Determine Goals, Produce Plan	2
Data Understanding	Collect Data, Describe Data, Explore Data, Verify Quality	3
Data Preparation	Select Data, Clean Data, Construct Data, Integrate Data, Format Data	3
Modeling	Select Model, Generate Test Design, Build Model, Assess Model	4
Evaluation	Evaluate Results, Review Process, Determine Future Steps	1
Deployment	Develop Strategy, Integrate Systems, Maintain, Collect Feedback, Document	1

Table 1. CRISP-DM Phases and Selected Outputs

3. TARGET AUDIENCE AND PREREQUISITES

This case is designed for undergraduate or graduate students in a statistics, data mining, or data analytics course. Students should be introduced to the basics of analytics and statistics. However, this assignment is limited to

the relationship between two variables and between two groups, so advanced knowledge is not required. No prior experience with AI is required, although prompt engineering may be discussed either before or after the assignment is completed.

4. IMPLEMENTATION

This assignment may be implemented in several different ways. Semester project groups of two to five students should be assigned or formed in advance. The assignment may then be given to each individual to complete, after which they discuss it within their groups. Completion of the assignment and initial group discussions should take roughly 20-30 minutes. Depending on prior knowledge, a discussion of linear regression assumptions, with an emphasis on linearity, should be conducted (10-15 minutes). The instruction should also cover critical thinking skills (10-15 minutes) before attempting the assignment. The discussion of the implications of the responses should then be held or presented as discussion boards (20-30 minutes).

Activity	Time
Critical Thinking	10-15 minutes
Model Assumptions	10-15 minutes
Assignment	20-30 minutes
Assignment Discussion	20-30 minutes

Table 2. Assignment Implementation Timeline

5. TEACHING CASE FOUNDATION

5.1 Learning Objectives

Upon completion of this case, students will be able to:

1. Critically evaluate AI-generated statistical interpretations using structured analytical frameworks (Ennis' logical, criterial, and pragmatic dimensions).
2. Identify violations of linearity assumptions in scatterplot visualizations through visual pattern recognition.
3. Construct and refine effective prompts through conversational AI interaction and chain-of-thought techniques.
4. Assess the reliability and consistency of generative AI outputs across different users and models.
5. Apply CRISP-DM Data Understanding phase concepts to justify data preparation decisions.
6. Articulate when human domain expertise should override AI recommendations in data analysis.
7. Demonstrate improved AI literacy by recognizing model training effects and prompt engineering importance.

5.2 Theoretical Framework

This case draws on three complementary pedagogical frameworks. In the Critical Thinking Framework, Ennis (1962) identifies three dimensions of critical thinking that provide structure for this case:

- Logical dimension: Students identify patterns and relationships in data visualizations
- Criterial dimension: Students apply statistical knowledge to evaluate AI claims against known assumptions (e.g., linearity in regression)
- Pragmatic dimension: Students make practical decisions about when to override AI recommendations based on domain expertise

Additionally, Constructivist Learning (Piaget, 1954; Vygotsky, 1978) is used, with students actively constructing understanding through AI interaction rather than passively receiving instructor explanations.

5.3 Summary

This assignment is a critical thinking exercise that also encourages students to interact with generative AI during either the Data Understanding or Data Preparation phase of the Cross-Industry Standard Process for Data Mining (CRISP-DM) or a similar phase in other machine learning or data mining models. Using Robert Ennis' three dimensions of critical thinking (logical, criterial, and pragmatic) (Ennis, 1962), it may also be delivered as an introductory assignment that encourages the use of generative AI in the course while discussing its limitations. The students need to have sufficient knowledge to evaluate the critical dimension of the response and enough confidence in themselves to override the AI tool's response.

Data visualizations are a popular tool for evaluating relationships between variables. For this study, students will upload an image that explores the relationship between years of service and wages for two positions at a fictitious company. Specifically, they will evaluate whether the relationship between years of service and wages is linear, which is an assumption of linear regression.

The visualization presented (Figure 1) is not intended to blatantly violate the linearity assumption, but rather to indicate that the relationship may be changing. This is something that not all AI models may pick up on, given a small number of records. However, when

combined with a user who critically evaluates visualization with knowledge of the problems and model assumptions, there is potential to improve the model by engineering features based on business principles rather than aiming for the best fit, which may lead to overfitting. Within the figure, Position 1 Wages become non-linear between Year 6 and 7. This would violate the linearity required for a linear regression and should be taken into consideration. Position 1 represents workers, and Position 2 represents supervisors, both of whom are paid hourly.

AI will also not necessarily provide consistent responses to similar prompts, which can cause an AI divide in the classroom, as students who have previously worked with AI on similar problems may receive better responses to their prompts. Through peer discussion, students will discover the need to train their model appropriately and to improve their ability to prompt AI to receive appropriate responses. To help facilitate this, they will be given a series of prompts to gauge the performance of their generative AI.

The objective of the case is to develop critical thinking skills by interacting with AI, analyzing responses, and questioning assumptions in data interpretation. Students will also learn to generate AI responses and critically evaluate their accuracy, biases, and limitations. Finally, through interactions with their classmates, they will also evaluate if their models are similarly trained and learn the importance of training their models to improve future results.

To maximize the pedagogical impact of this AI-enhanced critical thinking exercise, instructors should establish clear evaluation criteria that assess both technical competency and analytical reasoning. Students benefit from structured rubrics that evaluate their ability to craft effective prompts, critically assess AI-generated interpretations, and identify when generative AI fails to recognize subtle patterns in data visualization.

The assignment's success hinges on creating collaborative learning environments where students compare AI responses and identify inconsistencies, fostering discussions about variations in model training and the importance of human expertise in validating AI conclusions. By incorporating peer review sessions and reflective components, educators can ensure students develop not only technical skills in AI interaction but also the professional judgment necessary to leverage these tools effectively in real-world business contexts, ultimately preparing them for a future where AI augments rather than replaces human decision-making capabilities.

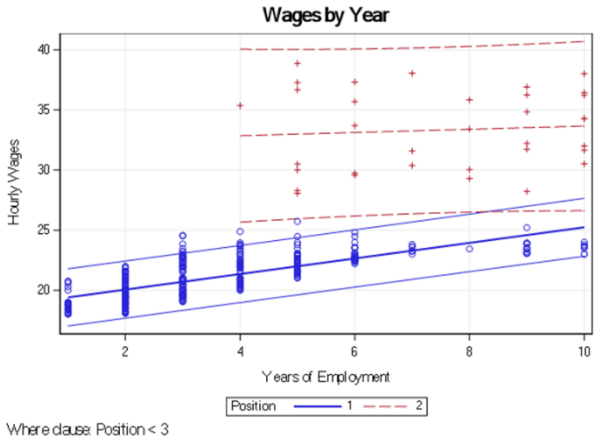


Figure 1. Wages by Year Visualization

6. CRISP-DM

This case employs the Cross-Industry Standard Process for Data Mining (CRISP-DM) (Wirth & Hipp, 2000; IBM, n.d. -a) cycle framework, which comprises six phases: business understanding, data understanding, data preparation, modeling, evaluation, and deployment (Wirth & Hipp, 2000), see Figure 2.

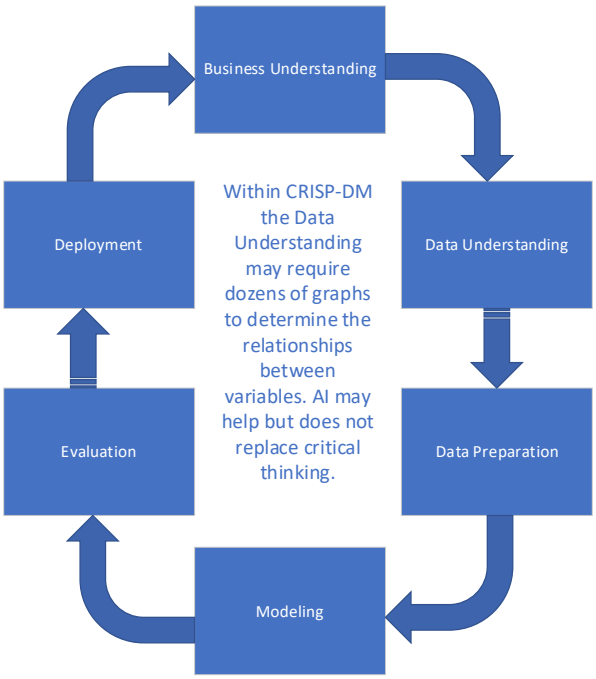


Figure 2. CRISP(DM) Data Mining Life Cycle

Business Understanding defines the project objectives and requirements from a business

perspective, converting them into a data mining problem definition that includes project management, situational assessment, and identification of business assumptions. A key assumption of the business may be that, for some positions, there is a rapid rise to equitable compensation early on, leading to lower salary increases once an employee has established seniority.

During the data understanding phase, the team collects initial data, describes its characteristics, and explores it to identify data quality issues, patterns, or initial hypotheses. In this phase, we may evaluate assumptions, such as linearity among the variables, to determine if a model is appropriate or if feature engineering is required. The case study is a part of the Data Understanding phase of CRISP-DM. The results are included in the example memo for the larger case used in the class, where it may be appropriate to engineer a feature that maximizes the influence of years of service. This may be something discovered at this phase, but it would be more appropriate to note it as a business assumption in the prior phase. The exploration should then lead to action in the Data Preparation phase.

In the Data Preparation phase, the team selects, cleans, engineers, features, and formats the data for modeling. The decision may be made to engineer a feature that caps the years of service used in the linear model.

Modeling involves selecting and applying various modeling techniques. These techniques include adjusting model parameters and evaluating each model's performance to determine its effectiveness.

Evaluation is the process of reviewing model results to ensure they meet business objectives and to determine whether additional steps or revisions are needed. In this case, the students would likely create a model that caps the number of years of service and then evaluate whether this improves the model fit.

Deployment is the phase that delivers the results, including reports, dashboards, or integrated models or systems, into the business environment. A model can be created to establish statistical control over employee salaries, which can then be used to determine whether employees are being paid equitably.

Each phase is meant to be connected to the others; however, without examples, students may lose that connection. This case serves as an example: business understanding provides the business goals and the project goals, while also assessing the situation, which may include listing assumptions.

One of the assumptions is that employee salaries for certain positions may rise earlier in an employee's tenure and then stabilize. The need to engineer a feature should be noted during the data understanding phase, as the data is explored, then in the data preparation phase, and finally modeled and assessed in the subsequent phases.

7. AI RESPONSE EVALUATION

Information systems education should incorporate AI into our courses, including allowing students to utilize AI in projects to enhance their learning (Zhang, 2025). By having students prompt AI in various ways to understand its limitations, they will develop skills essential in the modern workplace. Prompt engineering is the writing of prompts in a way that enables you to get the desired results from AI. The more knowledgeable students are about the problem's context and terminology, the more effective they will be at evaluating AI responses and adjusting their prompts. However, not all students will start at the same point with their AI. Different out-of-the-box models may yield different results or have been modified by the individual user through training. This represents one or more "shots of training" of the model by the individual student. In this way, the model may be improved to provide better results (Li et al., 2023).

For users who lack the knowledge or experience to create fully developed prompts, conversational prompting may be a more suitable approach (Ein-Dor et al., 2024). This allows students to engage AI conversationally rather than structuring a formal prompt, enabling AI to provide scaffolding for individual concepts, as students may focus on one area of a complex problem rather than creating a complex prompt. Here, having a conversation with AI about the relationships between a few variables and whether they meet an assumption would allow students to understand a smaller section of the analysis, rather than evaluating the whole process and model at once. This can be combined with a chain-of-thought prompt, which requires the user to understand the reasoning or train of thought that leads the model to make its response (IBM, n.d.-b; PromptingGuide.ai, 2025; Mitra et al.,

2024).

Another trend in AI prompting is its growing multimodality, allowing images and other media alongside text to be used in prompts (Mitra et al., 2024). Utilizing visualizations in prompts and discussing the results in conversations with AI will provide personalized scaffolding that instructors would not otherwise be able to provide easily. However, it is something the instructor needs to monitor, as prompt responses will not be consistent if they are too complicated or if the prompters use different models.

By having assignments that prompt discussions of their results, students may become aware of potential limitations as their prompts become more complex. It will also help train less-developed models, especially if students have varying levels of exposure to statistics and/or AI. Students can use AI for reflective learning. Reflective learning using AI refers to the process by which learners *critically assess* their experiences, decision-making processes, emotions, outcomes, and assumptions with the support of AI tools (such as large language models or generative AI), enabling them to identify strengths and weaknesses, deepen self-awareness, and improve future performance (Yuan & Hu, 2024).

8. CASE SETUP

The case presents a novel approach that enables students to interact with AI and with one another in the classroom. In this way, it promotes the use of novel technology, develops critical thinking skills, and helps build a learning community in the classroom. The assignment may be given as a formal assignment to be completed in advance of class or uploaded to a discussion board (Appendix C). Alternatively, the assignment may be given with a class period, and the class may discuss the concepts as they complete each prompt.

The students should be made aware, prior to the assignment, that some positions may experience a rapidly flattening wage-increase curve and that the linear regression assumption is based on a linear relationship between the dependent and independent variables. For this example, the dependent variable would be wages, and we want the AI to recognize that the relationship between years of employment and wages flattens between six and seven years of employment.

Students should be directed to use a generative AI tool, such as ChatGPT or Copilot, and to prompt the AI as detailed below. Between each prompt, students should discuss the assigned discussion question in small groups. Alternatively, suppose the student is in an online course. In that case, they should be directed to save their responses and to respond to each question in a single post, so the rest of the class can see and respond if they receive similar results. Critical Thinking tasks are abbreviated as CT in the list of prompts below.

Prompt 0: Upload the image with no additional comments.

Discussion Question 0.1 Did AI provide an adequate description of what the image was (CT – Pragmatic)?

Discussion Question 0.2 - Did AI note any change in the relationship of wages and years of employment for position 1 (CT – Logical)?

Prompt 1: Do the years of employment appear to have a linear relationship with wages?

Discussion Question 1.1 - Did AI note that the relationship was linear (CT – Logical)?

Discussion Question 1.2 - Did AI note any caution related to Position 1 having a changing relationship? If caution was noted, what was its chain of thought? Make an argument about whether the chain of thought is appropriate if provided (CT Pragmatic & Criterial).

Discussion Question 1.3 - Evaluate whether additional prompting is needed to elicit the model's reasoning process and justify your decision (CT Pragmatic & Criterial).

Prompt 2: Are you concerned about the values after year six being below the regression line?

Discussion Question 2.1 - Did AI note that there is a concern that the relationship may be changing (CT Logical)?

Discussion Question 2.2 - Did AI provide a reason why the relationship may be changing? If yes, what was it (CT Logical)?

Discussion Question 2.3 - Did AI provide a reason why the results may still be linear? If yes, what was it (CT Logical)?

Discussion Question 2.4 - Explain whether you agree with the AI and why (CT Pragmatic & Criterial).

Prompt 3: Would it make sense to cap the years of employment at seven? Why or why not?

Discussion Question 3.1 **-** Did AI provide a recommendation? If yes, what was it (CT Logical)?

Discussion Question 3.2 - Did AI justify? If yes, what was it (CT Logical)?

Discussion Question 3.3 Did AI provide alternatives? If yes, what were they (CT Logical)?

Discussion Question 3.4 - Make an argument as to why you would agree or disagree with the recommendation (CT Pragmatic & Criterial).

Prompt 4: What formula would I use in Excel to generate a variable with a maximum of seven years?

Discussion Question 4.1 - Did AI provide the correct formula (CT Criterial)?

Discussion Question 4.2 - How would you describe the value of AI and the human operator in this process (CT Logical, Criterial, and Pragmatic)?

9. CONCLUSIONS

This case provides a practical example aligned with CRISP-DM phases while introducing students to multimodal prompting. Given current AI capabilities, students should also be aware of inconsistencies in the responses generated by generative AI. The case mainly received positive feedback from students for its simple execution and relevance as a discussion topic. For many, the change in the relationship between wages and years of employment would not have been apparent at all. This should leave students feeling they need to critically analyze AI-generated output to add value to the analysis they are asked to perform.

10. CASE LIMITATIONS

This case provides a straightforward introduction to critical thinking with AI in data analytics, but instructors should be aware of several limitations when implementing it.

AI Model Evolution and Variability
This case was developed and tested with specific versions of generative AI (primarily ChatGPT 3.5, ChatGPT 4, and Microsoft Copilot) during 2023-2025. AI models are continuously updated, and their responses to the same prompts can change over time. This creates several challenges:

Model Updates: A strength of this case is that it reveals AI's inconsistencies and limitations. However, if future AI versions consistently detect the non-linearity issue, the pedagogical value may shift. Instructors should pilot the exercise with current AI versions before each semester to understand likely student experiences. If AI has improved significantly, the case still works. The discussion can shift from AI's limitations to its growing capabilities. The critical thinking framework remains valuable in either scenario.

Response Variability Within Sessions: Even with the same AI version, students may receive different responses depending on their account history and prior interactions with the AI. This variability is pedagogically functional, as it prompts discussions about model training and the importance of consistent analytical processes. However, it can be frustrating for students who expect deterministic outputs. Instructors should frame this variability as part of the learning objective rather than a problem.

Technology Access and Equity
AI Account Requirements: Students need access to a generative AI tool capable of processing images. As of this writing, several options exist with free tiers (ChatGPT, Microsoft Copilot, Google Gemini, Claude). However, free-tier limitations may affect the student experience. Some students may have paid subscriptions that provide access to more advanced models, potentially creating inequity in the quality of AI responses. Instructors should discuss this openly and frame it as an example of how AI access itself can create workplace advantages.

Prerequisite Knowledge Assumptions Statistical Background: This case assumes students have encountered linear regression and understand the concept of assumptions, even if they cannot articulate them formally. Students with no prior exposure to statistics may struggle to evaluate whether the visualization violates the linearity assumptions. Instructors should assess whether students need a brief review of linear regression concepts before the exercise.

CRISP-DM Familiarity: The case is designed for courses using the CRISP-DM framework. Students unfamiliar with this process model may not fully appreciate how the Data Understanding phase connects to subsequent phases. Instructors using different frameworks (e.g., KDD, SEMMA) should adapt the language and connections accordingly.

Data Visualization Literacy: Students should be able to interpret scatterplots with trend lines. Those with limited exposure to data visualization may need additional scaffolding to identify patterns visually.

Despite these and other implementation limitations (e.g., Face-to-Face or Online), instructors can adapt the case to different class sizes, exercise durations, and student experience

levels. The case's core pedagogical value, to develop critical thinking about AI outputs, remains relevant even as specific AI capabilities evolve. Instructors should view these limitations as opportunities to adapt and contextualize rather than barriers to implementation.

11. REFERENCES

Akhtar, R. (2025, March 27). *AI will not replace you. A human using AI will*. *Forbes*. Retrieved August 15, 2025, from https://www.forbes.com/sites/reeceakhtar/2025/03/27/ai-wont-replace-you-a-human-using-ai-will/

Collier, C. A., & Powell, A. L. (2024). Data Analyst Competencies: A Theory-Driven Investigation of Industry Requirements in the Field of Data Analytics. *Journal of Information Systems Education*, 35(3), 325–376. https://doi.org/10.62273/SPYC4248

Ein-Dor, L., Toledo-Ronen, O., Spector, A., Gretz, S., Dankin, L., Halfon, A., & Slonim, N. (2024). Conversational prompt engineering. https://doi.org/10.48550/arXiv.2408.04560

Ennis, R. H. (1962). *A concept of critical thinking* (p. 84). Harvard Educational Review.

Gonzalez, A. (2023, August 22). *IBM study: AI won't replace people, people who use AI will replace people who don't*. *Going Concern*. Retrieved August 15, 2025, from https://www.goingconcern.com/ibm-study-ai-wont-replace-people-people-who-use-ai-will-replace-people-who-dont/

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning.* Boston: Center for Curriculum Redesign.

IBM. (n.d.-a). Modeling. In IBM SPSS Modeler SaaS documentation. Retrieved August 15, 2025, from https://www.ibm.com/docs/en/spss-modeler/saas?topic=guide-modeling

IBM. (n.d.-b). What is chain of thought (CoT) prompting? IBM Think. Retrieved August 15, 2025, from https://www.ibm.com/think/topics/chain-of-thoughts

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groß, C., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Larissa, N., Schlag, B., & Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences, 103,* 102274. https://doi.org/10.1016/j.lindif.2023.102274

Li, Y., Hui, B., Xia, X., Yang, J., Yang, M., Zhang, L., & Li, Y. (2023). One-shot learning as instruction data prospector for large language models. https://doi.org/10.48550/arXiv.2312.10302

Mitra, C., Huang, B., Darrell, T., & Herzig, R. (2024). *Compositional chain-of-thought prompting for large multimodal models.* In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (pp. 14420–14431). IEEE. https://doi.org/10.1109/CVPR.2024.01445

Piaget, J. (1954). *The construction of reality in the child.* Basic Books.

PromptingGuide.ai. (2025, July 5). *Chain-of-Thought (CoT) prompting*. Retrieved August 15, 2025, from https://www.promptingguide.ai/techniques/cot

Sundberg, L., & Holmström, J. (2024). Teaching Tip: Using No-Code AI to Teach Machine Learning in Higher Education. *Journal of Information Systems Education,* 35(1), 56–66. https://doi.org/10.62273/CYPL2902

Wirth, R., & Hipp, J. (2000, April). CRISP-DM: *Towards a standard process model for data mining.* In Proceedings of the 4th International Conference on the Practical Applications of Knowledge Discovery and Data Mining (Vol. 1, pp. 29–39).

Yuan, B., & Hu, J. (2024, November 19). *Generative AI as a tool for enhancing reflective learning in students*, https://doi.org/10.48550/arXiv.2412.02603

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Harvard University Press.

Zhang, X. (2025). Teaching Tip: Incorporating AI Tools Into Database Classes. *Journal of Information Systems Education,* 36(1), 37–52. https://doi.org/10.62273/GKZI247

APPENDIX A

Relevant Parts of the Business Understanding Phase

Business Understanding

Determine Business Objectives

Background

Widget Inc. has several locations where it provides goods and services to local consumers. The executives at Widget Inc. are concerned about labor cost equity and want to establish statistical controls to monitor whether employees are paid fairly. They have had employees complain of discrimination based on height and gender, and may be facing a lawsuit.

Objectives

The primary objective of this analysis is to determine what factors influence salary at Widgets Inc. The analysis will evaluate how performance, location, position, and experience influence salary. Furthermore, the constructed model is intended to enable the company to test for discrimination based on height or gender and to provide human resources with a tool to identify outliers that may indicate salary issues within the organization.

Business Objectives Success Criteria

Success will be determined by the ability to create a model accurate enough to establish statistical controls to monitor fair pay within the organization. An essential metric the company wants to establish is a performance-based salary increase baseline.

Data Mining Tools

Our team has access to Excel, SAS Studio, and SAS Viya

Data Sources
Human resources has provided us with a CSV file containing 400 records and 8 attributes, including salary, position, location, performance review, on-the-job errors, gender, height, and years of employment.

Other Resources

This could be money, or other teams or organizations with unique skills.

Requirements

Schedule: Analysis will be complete by the Final Documents due date (look up the due date). Final recommendations will be completed by the due date of the presentation (look up the due date.

Quality: The project will detail all steps to prepare the data, verify the model's appropriateness, assess its accuracy, provide a detailed analysis of the results, and make recommendations based on the analysis. (NOTE: We will revisit this section as we conduct our analysis to add detail.)

Security: No results should be shared with anyone outside the team or human resources, as employees may be inferred from even minimal analysis.

Legal: The organization is legally required to protect personal information and to ensure equal pay for equal work regardless of gender, race, etc.

Data Mining Goals

Our analysis should provide a model to estimate an employee's salary, allow for statistical control of salary, and estimate the influence of years of service and performance on salary.

Data Mining Success Criteria

A model explaining more than 80% of the variance and estimates with 95% confidence of the impact of the years of service and performance. The model needs to be simple enough to allow continual review at a nominal cost.

APPENDIX B

Sample Data

EmpID	Location	Position	Hourly Wages	On the Job Errors	Performance Review	Years of Employment	Height	Gender
3464555	10	1	23.21	1	19	9	63	M
3511683	2	2	33.69	1	19	6	70	M
3517969	11	3	72.71	1	19	9	74	F
3519233	5	1	20.85	13	7	2	68	F
3526791	8	1	18.55	11	9	2	77	M
3533586	11	6	139.29	3	17	8	64	F
3538924	10	1	19.9	11	9	3	61	F
3552242	5	1	19.77	14	6	2	65	M
3571609	3	1	22.93	2	18	6	73	M
3597660	6	1	21.1	7	13	2	72	M
3602023	1	1	18.77	16	4	1	75	F
3680725	8	1	20.7	7	13	4	69	F
3681183	11	4	46.85	2	18	10	67	F
3698777	10	1	19.95	15	5	3	65	M
3717787	3	1	18.12	15	5	2	78	M
3735292	11	3	63.01	0	20	7	76	F
3745587	5	1	23.74	1	19	4	64	F
3791596	7	1	20.53	8	12	3	67	F
3793117	1	1	19.79	9	11	2	73	M

APPENDIX C

Example of an AI Assignment

Assignment: Critical Thinking in AI-Assisted Data Interpretation

Objective

This assignment will help you develop critical thinking skills by interacting with AI, analyzing responses, and questioning assumptions in data interpretation. You will generate your own AI responses and critically evaluate their accuracy, biases, and limitations. You will also interact with your classmates to evaluate the consistency of your AI's responses to the prompts.

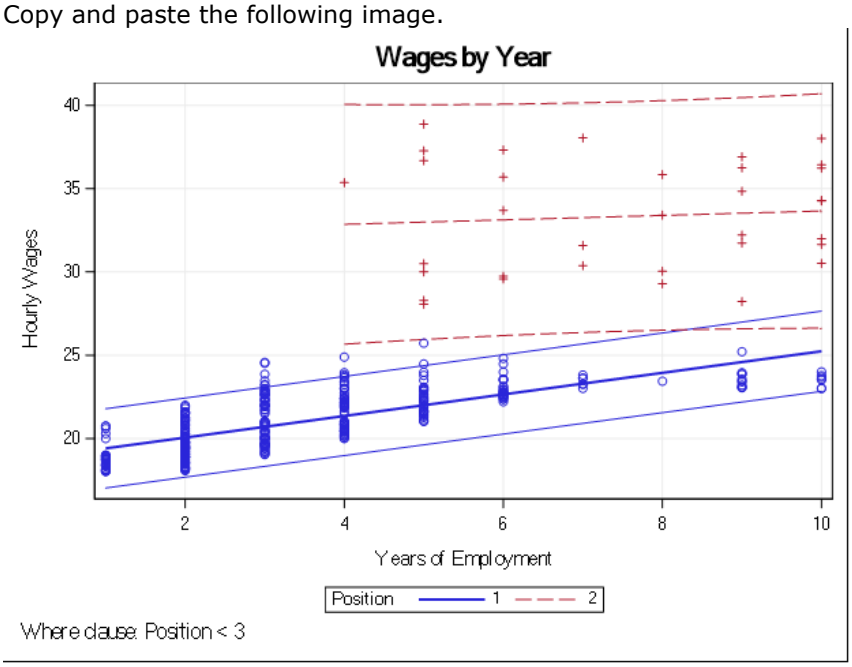
Instructions

Part 1: Engage with AI

1. **Use the following prompts to interact with https://chatgpt.com** one at a time and record the responses.
2. Do **not** guide the AI in any direction—let it generate its own reasoning.
3. Copy and paste the AI's responses into your assignment document.

Prompts to Use:

- Copy and paste the following image.



-

- *Prompt 1: Do the years of employment appear to have a linear relationship with wages?*
- *Prompt 2: Are you concerned about the values after year 6 being below the regression line?*
- *Prompt 3: Would it make sense to cap the years of employment at 7? Why or why not?*
- *Prompt 4: What formula would I use in Excel to generate this variable?*

Part 2: Critical Analysis

For each AI response, answer the following:

1. **Does your AI response match your group?**
2. **Did the AI response express concern over linearity before prompt 2?**
3. **What recommendation did AI provide for capping the years of employment?**
4. **Do you agree with the recommendation? Why or why not?**

Part 3: Reflection & Summary

Write a **brief reflection** on what you learned from this exercise. Consider:

- Did the AI responses align with your expectations?
- Did you find any biases or limitations in the AI's reasoning?
- How did questioning the AI responses deepen your understanding of data interpretation?
- What do you feel your role is in data understanding, given the rise of generative AI?

Grading Criteria:

- **Engagement (30%)** – Did you record and present the AI's responses accurately?
- **Critical Analysis (40%)** – Did you effectively evaluate and critique the AI's reasoning?
- **Reflection (30%)** – Did you demonstrate thoughtful learning from the exercise?

Prompt	Response
Image	
1	
2	
3	
4	