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Developing Business Process and Query Skills for Solving Business Problems

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ABSTRACT: This case offers learning experiences for (1) following a business process diagram for car dealers' recording of sales and sales returns of new cars and the car manufacturer's subsequent recording of the same transactions and (2) querying a database to determine why dashboards maintained by the dealers and the manufacturer do not always agree. Scaffolding resources (videos and script with screenshots) enable learners with no querying experience to work the case as they develop basic query skills. For learners with query skills, the case (without scaffolding resources) can be used as a data analysis project covering all major query operations. The data can be queried in any structured query language (SQL) platform. The case offers practice and quiz questions for assessing business process skill and the query skills of joining tables, aggregating data, setting criteria, using built-in functions, developing expressions, and verifying query correctness.

Keywords: business process diagram; business process modeling; inferences; querying; revenue recognition; SQL.

I. THE CASE

The Scene

Tino is an accountant at an independent dealership that sells new cars from CarStar Company. Aliza is the accounting manager for the dealership.

Tino: Dealer dashboards and the CarStar dashboard don't always agree on counts for vehicle sales. Sometimes, CarStar's dashboard shows more unit sales than dealer dashboards show. How much effort should I put into figuring out the discrepancies to identify what's happening (or not happening)?

Aliza: Because the dashboards should agree with no more than a few hours' lag, please query to isolate the discrepancies. The IT crew can give you a database with sales data as we (the dealers) recorded it in our accounting system and as CarStar recorded it in its accounting system.

Tino: Will do!

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Supplemental material is available online, as linked in the text.

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What You Will Learn from This Case

Working this case helps you learn to:

1. Read and follow a business process diagram (BPD), which has become the preferred approach for representing business process, supplanting the flowcharts developed in the 1940s. The BPD notation, first released in 2004, was designed to enable organizations to operate at internet speed. BPDs provide visual depictions of business processes that can help anyone with a need to understand the processes: users, system developers, managers, and auditors.

   Rely on the business process to solve the business puzzle; that is, figure out why the records in two databases (the dealers' database and the manufacturer's database) that are supposed to have the same data do not match. The puzzle concerns the timing of revenue recognition accounting, where the BPD shows the sequences of transaction recording.
2. Use a query-by-example (QBE) interface to analyze data to solve a business puzzle that requires understanding the underlying business process from a BPD. Although it features the QBE interface, the case also reveals the SQL code that the interface generates to execute the queries.

Requirements

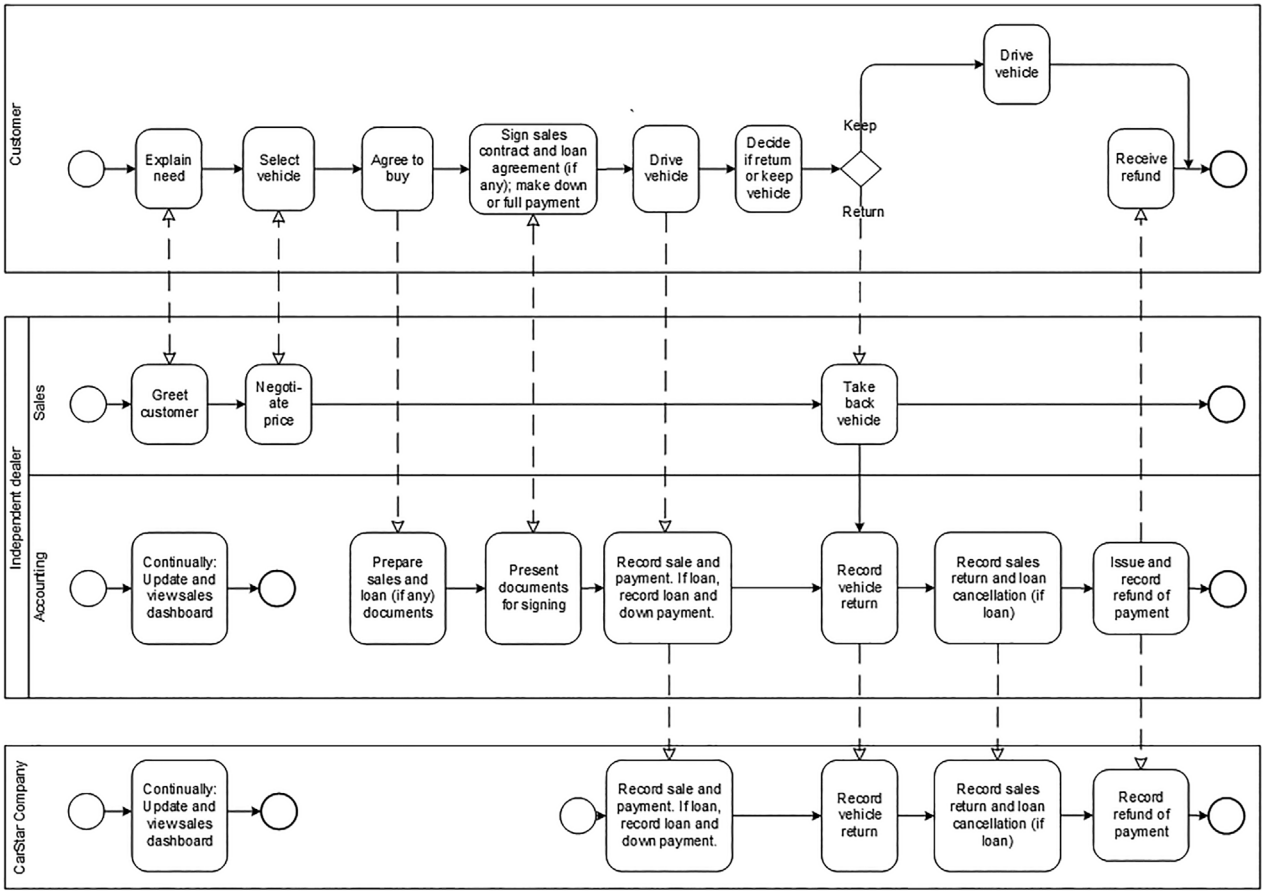
Part 1: Business Process

Based on the conversation above and Exhibit 1, answer the following questions:

1. Identify the steps in the revenue-generating process in the business process diagram (BPD) and follow a sale transaction beginning with a potential buyer entering the dealership.

EXHIBIT 1

Business Process Diagram (BPD): Independent Dealer Sales of CarStar Vehicles



2. Answer the following questions about the business process:
   a. Who are the participants in the process?
   b. What do the different shapes signify?
   c. What do the arrows indicate about the process?
   d. What is the significance of having solid and dashed flow lines?
   e. How does the BPD distinguish between the actions of different participants?
   f. What transactions are recorded?
   g. Which participant records transactions first?
   h. How do you know which participant records transactions when?
   i. What factors determine which transactions are recorded?
3. Answer questions your instructor will provide about following the business process and identifying mismatches between text explaining a process and a BPD representation of it.

Part 2: Querying to Find Data Discrepancies

1. Save the file CarStarData.accdb to your disk.
2. Query the database, assuming the role of Tino for the assignment.
3. Write a one-paragraph memo to Aliza with your findings.
4. Answer questions your instructor will provide.

INDEX OF SUPPLEMENTAL MATERIALS

CarStarData.accdb

II. CASE LEARNING OBJECTIVES AND IMPLEMENTATION GUIDANCE

Learning Objectives

The learning objectives are for students to learn to:

1. Understand and follow a business process from a business process diagram (BPD);
2. Distinguish between correct and incorrect representations of business processes;
3. Make inferences about a business process;
4. Develop sufficient query skill to find data discrepancies; and
5. Interpret query results that identify data discrepancies.

The learning objectives model tasks that accountants perform, including (1) understand and follow business processes depicted in graphical representations, (2) identify potential causes of data discrepancies, (3) query to find data discrepancies, and (4) interpret the meaning of the data discrepancies revealed with querying. In Borthick's (1996) categorization of learning objectives for the Accounting Information Systems (AIS) course, the case pertains to the documentation objective of understanding symbolic representations of processes and information use objectives of (1) deciding what information would be relevant to solving a business problem, (2) extracting the needed information, and (3) analyzing the information to solve the problem.

Implementation Guidance

The case provides scaffolding resources that enable learners at varying levels of business process and query skills, from none to extensive, to benefit from the case. For learners with neither business process nor query skills, all parts of the case are appropriate. Learners that already have business process skills may not need the requirements in "Part 1: Business Process," subparts 1 and 2; instructors can use the case's practice and quiz questions to assess learners' business process skills. For learners with no query skills, instructors can use the videos (CarStarX.mp4 where X = 1–5, included in the Teaching Notes) and/or the script with screenshots (provided in the Teaching Notes) to show learners how to do the querying. The practice and quiz questions enable instructors to assess learning without grading query files. For learners with prior query experience, instructors could offer students the conversation and the database. If students need more guidance, they could be offered the Query Strategy Guide available in the Teaching Notes. In either case, business process and query skills can be assessed with the quiz questions.

Although the script and videos were created for querying with the Microsoft Access QBE interface, any SQL platform can be used. CSV files (CStarSale.csv, CStarSaleReturn.csv, DlrSale.csv, and DlrSaleReturn.csv) (included in the Teaching Notes) with the data tables are provided to facilitate loading the data into SQL platforms. To facilitate grading of SQL code, students' code could be submitted to an automated grader, such as Coyne, Summers, and Wood's (2023) robotic process grading tool. Some resources that would be helpful to students wanting to learn to code SQL are

1. LinkedIn Learning courses for "basic SQL";
2. Shields (2019); and
3. Teate (2021).

To generalize the case to the resources, events, agents (REA) ontology (McCarthy 1982, 2003; Dunn 2013; Gailly and Geerts 2014), an optional requirement is available in the Teaching Notes. It requires students to create an REA database design pattern (REA model) for the events in the BPD.

Role of Integrated Business Process and Data Analytic Skills

Database querying has been fundamental to analyzing structured data since relational database systems (based on relational algebra and calculus) were introduced in the 1980s. Relational systems enable the recording, representation, and manipulation of structured transactions, like those that pervade accounting. Enterprise resource systems (ERPs) became synonymous with relational database systems because they were built on relational technology. Creating reports or extracting data from ERPs thus entails querying a relational database, which has become an essential skill for accountants. The importance of database skills is evident in AACSB Accounting Standards, included as data analytics in the 2013 standards and refined in the 2022 update of the 2018 standards (AACSB 2022), and incorporated into the Uniform CPA Examination Blueprints for the CPA exam beginning 2024 (AICPA 2020).

Flowcharts were the first widely used graphical depictions of business processes, standardized by the American National Standards Institute (American National Standards Institute (ANSI) 1970). The desire to do business at internet speed prompted the formation of the Business Process Management Institute (BPMI), which created the notational

framework for business process diagrams (BPDs) in 2004 and updated in 2016 (Object Management Group (OMG) 2011; Gagné and Ringuette 2016). BPDs have fewer different symbols than flowcharts; unlike flowcharts, BPDs do not use symbols to depict technology implementation. Furthermore, BPDs make the synchronization of process flows explicit, horizontally across time and vertically between participants. By reducing flowcharts' representational complexity, BPDs help anyone needing to work with business processes in organizations: users, analysts/programmers, managers, and auditors. The notation quickly became widely used. System development platform architects used BPDs to facilitate top-down design and implementation of self-documenting systems in which developers specified business processes for which code was then written. Training for learning to create BPDs from conversation and making inferences from them is available in Borthick and Schneider (2018).

Accountants have always needed an understanding of business processes because analyzing accounting data requires it. Business process skills became more salient as analysis of accounting data embraced complete transaction datasets, not just ledger-level summaries, and as the incremental improvement of business processes became more important (Benioff 2019). Chief digital officers have called this continuous iteration of products and services (making small incremental improvements quickly), now widely known as the minimum viable product with rapid iterations (Newman and Blanchard 2016; Siebel 2019; Smith and Browne 2019). The joint importance of data analytics and business processes emerged in the AICPA's 2019 practice analysis. In the words of Rich Gallagher, senior director of content for the AICPA Examinations team, in a *Journal of Accountancy* podcast:

> [D]ata analytics is very important. Another thing we heard is understanding business processes kind of from the front to the back. So whether you're starting with a sales order process, you start at the sales order and trace that all the way through until the cash is collected from the accounts receivable. Looking at that what happens along the entire route of those transactions, being able to follow the data as well as understanding where systems and information systems support the data throughout that entire series of transactions. (Vien and Gallagher 2019)

Although there is a published case designed to develop basic spreadsheet skills (Borthick and Schneider 2023), developing basic query skills has been left principally to textbook chapters introducing simple querying. The earliest case for this purpose was Borthick, Jones, and Kim (2001), an elementary case whose business context is outdated. Although there are many querying cases, each one typically covers only a subset of basic query skills. Although this case was developed to bridge the gap between no query experience and sufficient skills for query projects of modest complexity, it is also suitable as a project for query practice for learners with some prior query experience.

Use in Courses

The case is suitable for courses in which basic query skills are needed, such as accounting information systems (AIS), auditing, and managerial accounting. It is also usable as an assessment of query skills wherever such an assessment would be desirable.

The case has been used in the AIS course at one large public university for three years by two instructors in nine sections (University 1: 450 students) and at another large public university for two years by one instructor in eight sections (University 2: 281 students). At a third large public university, it has been used by one instructor in one section of an auditing course and in two sections of a managerial principles course (University 3: 93 students). At all three universities, the case was the first learning experience for developing business process and query skills.

At University 1, the case BPD work preceded use of Borthick and Schneider (2018) training for learning to develop a BPD from conversation. With this case first, the instructor believed students already had an understanding of BPD representation of business processes, which enabled them to construct the BPD in Borthick and Schneider (2018) more quickly. Before taking the BPD and querying quizzes, students had access to the practice questions. Over six terms at this university, mean quiz scores out of ten points were 7.7 points for the BPD questions and 6.5 points for the query questions.

At University 2, the case was used in teaching McCarthy's REA ontology for value system, value chain, business process, and task level (McCarthy 1982, 2003; Dunn 2013; Gailly and Geerts 2014). Although the case BPD does not link explicitly to concepts the instructor emphasized (such as the economic duality of the sales process), it offers an authentic example of the sales process and the revenue cycle overall, with a variation showing returns and recordkeeping at two entities. In class, the instructor pointed out pattern similarities and discussed the conceptual linkages with other business process examples used in the class.

At University 3, the case was used in two different settings. First, it was used near the end of an auditing course in which accounting students had learned internal control principles, systems flowcharting, and had used Access to perform substantive tests of account balances. The case was their first exposure to BPD notation. Second, it was used in a

managerial principles course to provide business students their first experience with BPD notation and answering accounting questions through querying.

Over three years of case use, we have refined it to enhance students' learning experience. We clarified the script in response to student comments. Venn diagrams were added to illustrate the difference between inner and outer joins. Data for a second dealer were added to give students experience using the Group By operator in two ways: to apply built-in functions directly from the Group By pulldown menu and to roll up analysis results with selective omission of attributes to obtain higher levels of aggregation.

Case Efficacy

Responses to the Learning Experience: Business Process in the BPD

Students found many aspects of the case helpful, noting the "consistency of…vocabulary," the "explanations and visual confirmation," and that "the steps were very clear and easy to follow." Students commented favorably on the graphic elements, stating the "visuals" and "screenshots" helped them "compare our work" and determine "how it was supposed to look" and noting that the "pictures were very helpful to see I was doing it right."[1]

Students in two sections at University 1 (large public) responded to questions about their experience with the BPD, where the endpoints of the scale were 1 (hard) and 5 (easy), as shown in Table 1. The endpoints were reversed for some questions; that is, some questions had "hard" as the first choice whereas other questions had "easy" as the first choice. The variation across student responses was consistent with students' heeding the wording differences across the questions. Because the responses across the two sections were similar, they are combined in the table. From the students' perspective, the easiest of the five aspects was "Figuring out the branching of the process when a gateway symbol had two paths" (mean = 3.28). The hardest aspect was "Identifying errors in the BPD" (mean = 2.29). The result of four means below and one mean above the midpoint (3.00, "neither easy nor hard") is consistent with students finding the BPD challenging to use but within their grasp. Student mean response to a sixth question "The prospect of learning to create BPDs from conversation strikes me as:" was 3.72, which is consistent with at least modest interest in furthering their skill with BPDs. The mean response to the question "Outside of class sessions, how many minutes did you spend examining the BPD?" was 39 minutes, a reasonable amount of time spent on a new notation.

Students responded to a subsequent question "Which of the following tasks were hard?" and selected all the items from the list that they wished. Collectively, the students chose all the potential difficulties. Table 2 shows the mean proportions of students making each selection. The choices were presented in the order in which students would have encountered the features while working on the case. The most frequently selected difficulties were "Recognize errors in a process sequence" (65 percent) and "Recognize when process symbols are missing" (57 percent). The least frequently chosen difficulties were "Follow the actions of a participant" (10 percent) and "Follow the process when it passes from participant to another" (24 percent).

TABLE 1

Student Perception of Difficulty of Case Aspects: Business Process in the BPD

Number	Aspect	Mean[a] n = 76
1	Following the actions of a specific participant was:	2.83
2	Following the flow from one participant to another one was:	2.91
3	Figuring out the branching of the process when a gateway symbol had two paths from it was:	3.28
4	Making inferences from the BPD was:	2.95
5	Identifying errors in the BPD was:	2.29
6	The prospect of learning to create BPDs from conversation strikes me as:	3.72
7	Outside of class sessions, how many minutes (approximately) did you spend examining the CarStar BPD?	39 minutes

[a] Scale endpoints for Questions 1–6: 1 = hard and 5 = easy.

[1] Data from students about their experiences with CarStar were approved by the first author's Institutional Review Board (IRB) as secondary data in accordance with 45 CFR 46.116, 45 CFR 46.116 f, and 45 CFR 46.117 c.

TABLE 2

Student-Indicated Difficulties Using the BPD: Multiple Items

Item Order[a]	Difficulty	Proportion Selecting n = 76 (%)
1	Follow the actions of a participant	10
2	Follow the process when it passes from one participant to another	24
3	Identify processes that record transaction data	31
4	Make inferences about the behavior of a process	42
5	Recognize errors in a process sequence	65
6	Identify errors in the flow direction	40
7	Identify process symbols appearing in the wrong order	44
8	Recognize when process symbols are missing	57
9	Recognize when gateways (decisions) are missing	53
10	Recognize when a process occurs in the wrong participant's lane	38
11	Find processes with incomplete or erroneous text labels	51

[a] Sequence of the potential difficulties in the list in the order they would have been encountered in performing the querying.

Responses to the Learning Experience: Querying

Students in two sections at University 1 responded to questions about their experience with querying the CarStar data from the script with screenshots (Table 3), where the endpoints of the scale were 1 (hard) and 5 (easy). Because the responses across the two sections were similar, they are combined in the table. The question "Querying from the directions in the script was:" had a mean of 2.89. The mean response to the question "Recognizing when the querying was correct was:" was 3.09. The outcome of one mean slightly below and one mean slightly above the midpoint is consistent with students experiencing the querying as challenging but doable.Students responded to subsequent questions about how long they worked on the querying and how many times they did it. The mean time spent for the first/last time querying the data was 1.96/1.03 hours, where the mean number of times they completed the querying was 2.82. Almost halving the time to complete the querying from the first to the last take indicates that querying speed increased with practice.

Another question asked "Which of the following tasks were hard?," and students selected all the items from the list that they wished. Collectively, the students chose all the tasks. Table 4 shows the mean proportions of students making each selection. The choices were presented in the order students would have encountered the tasks while working on the case. The most frequently selected tasks were "Develop expressions in the Expression builder to do calculations" (47 percent), "Verify that queries give correct results" (47 percent), and "Interpret null results" (46 percent). The least frequently chosen difficulties were "Create, save, name, and close queries" (4 percent), "Find/designate primary keys; copy/rename tables; add data to tables" (9 percent), and "View tables and queries in data and design views" (10 percent).

TABLE 3

Student Perception of Difficulty of Case Aspects: Querying

Number	Aspect	Mean[a] n = 72
1	Querying the CarStar database from the directions in the script was:	2.89
2	Recognizing when the querying was correct was:	3.09
3	Approximately how long in hours did you spend querying the first time you did it?	1.96 hours
4	How many times did you do the querying?	2.82 times
5	Approximately how long in hours did you spend querying the last time you did it?	1.03 hours

[a] Scale endpoints for Questions 1 and 2: 1 = hard and 5 = easy.

TABLE 4

Student-Indicated Difficulties with Querying: Multiple Items

Item Order[a]	Difficulty	Proportion Selecting n = 70 (%)
1	View tables and queries in data and design views	10
2	Find/designate primary keys; copy/rename tables; add data to tables	9
3	Create, save, name, and close queries	4
4	Create and interpret inner joins	24
5	Populate queries with attributes	16
6	Interpret null results (queries showing no results)	46
7	Use Group By to apply built-in functions (Count, Avg, Min, and Max)	13
8	Use queries as input to other queries	27
9	Set criteria to select specific data from tables or queries	30
10	Use built-in navigation to find function templates	26
11	Use built-in help to find lists of parameter values for functions	27
12	Develop expressions in the Expression builder to do calculations	47
13	Verify that queries give correct results	47
14	Reorder attributes in Design View and Results View to improve readability	31
15	Use Group By to summarize results by attribute value	30

[a] Sequence of the potential difficulties in the list in the order they would have been encountered in performing the querying.

Teaching Notes

The Teaching Notes contain:

1. An optional requirement for students to prepare an REA database design pattern for the events in the CarStar BPD and the solution
2. Suggestions for debriefing students and revealing the authenticity of the case
3. Links to files containing:
   a. File with queries: CarStarQueries.accdb (included in the Teaching Notes)
   b. Excel files with the data in .csv format: CStarSale.csv, CStarSaleReturn.csv, DlrSale.csv, and DlrSaleReturn.csv
   c. MP4 files with videos for querying the database
   d. SRT files for video captioning
4. Part 1: Responses to the business process questions
5. Part 2: One-paragraph memo to Aliza with findings from the querying
6. Practice and quiz questions formatted for Respondus-enabled importing into a learning management system (LMS) for:
   a. Part 1: Business Process
   b. Part 2: Querying to Find Data Discrepancies
7. Query strategy guide for students with query skills that need help with querying
8. Text script with screenshots for querying the database
9. SQL code for queries by query name

III. SUMMARY

This case was designed to develop students' business process and database querying skills. For business process, students learn to use a BPD to follow business processes and assess the faithfulness of BPD representations of business processes to statements about them. For querying, the case offers a query project for finding data discrepancies in an authentic setting. The case presents the business process in a BPD depicting revenue recognition at a car dealer and then provides practice and quiz questions that prompt learners to follow the process and identify mismatches between text explaining a process and a BPD representation of it. Once they understand the business process of the sequence of transaction recording, learners perform the querying to find data discrepancies. The query operations include configuring

joins, aggregating data, setting criteria, using built-in functions, developing expressions, and verifying query correctness. Querying the data isolates discrepancies between the two versions of the sales data (dealer and car maker), creating the need for students to interpret the meaning of the data discrepancies.

The case can be productive for learners at varying levels of business process and querying skills, from none to extensive. Instructors can configure the case's scaffolding resources to make the case a challenging but doable project for their learners. Regardless of the scaffolding assistance offered to learners, the practice/quiz questions can be used to assess business process and query skills. The case has been used successfully in a variety of accounting courses at several universities.

TEACHING NOTES

Teaching Notes are available only to full-member subscribers to the *Issues in Accounting Education* through the American Accounting Association's electronic publications system at https://publications.aaahq.org. Full-member subscribers can use their usernames and passwords for entry into the system where the Teaching Notes can be reviewed and printed. Please do not make the Teaching Notes available to students or post them on websites.

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