ENHANCING DATA MANAGEMENT EDUCATION THROUGH EXPERIENTIAL LEARNING

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ABSTRACT

The design and implementation of information systems contribute to the practical knowledge of students. This article introduces an active learning environment in an International Data Management course. Specifically, we highlight how classroom lectures can be enhanced by the experience and application of a real-world project-based study. Gold Rush Antiques is a real-world database management case. Gold Rush is a business with multiple locations which has experienced tremendous growth. The scenario engages students in the design and development of a database to advance the organization and analysis of the data. This case is created at various levels of data management coursework – beginning, intermediate, or advanced. The case scenario is written at a beginner level; teaching notes have intermediate and advanced suggestions (provided upon request). Students are requested to develop a working prototype of a database management system that includes the design of data, tables, forms, queries, and reports. The Gold Rush Antiques case study allows students to not only learn the development of a database but also understand how to examine, analyze, and apply business procedures.

Keywords: Database Case Project, Database Development, Management Information Systems, Database Management System, SQL

INTRODUCTION

In an increasingly data-centric business landscape, the ability to understand and manage data systems is no longer confined to the realm of information systems (IS) professionals. Business leaders are expected to make informed decisions based on structured, reliable data, which necessitates a foundational understanding of how data is stored, accessed, and analyzed (Laudon & Laudon, 2020). Despite this reality, many undergraduate business programs continue to

underemphasize the technical competencies necessary to work effectively with data, particularly in database design.

In the context of database education, Coronel, Morris and Rob (2019) advocate for experiential exercises to reinforce database theory, whereas Rob and Coronel (2019) highlight the pedagogical benefits of simulating real-world scenarios. Research consistently supports the value of active learning in technical education. The teaching strategy draws on the principles of experiential learning (Kolb, 1984), situated learning (Lave & Wenger, 1991), and case-based reasoning (Aamodt & Plaza, 1994), offering a structured framework for building practical skills in tandem with conceptual knowledge. Freeman et al. (2014) demonstrated that active learning increases student performance in STEM disciplines, while Biggs and Tang (2011) emphasize the alignment of constructive alignment in course design, encouraging students to "learn by doing."

In Data Management courses, project-based learning (PBL) and real-world case studies enable students to apply data modeling, normalization, and querying techniques in authentic contexts (Kolb, 1984). Teaching database design within the business curriculum offers students critical skills that support data-driven decision-making, operational efficiency, and cross-functional communication. By integrating practical examples and real-world case studies, educators can enhance student engagement while demonstrating the tangible impact of well-structured data systems on business outcomes (Coronel et. al., 2019).

This paper argues that incorporating database design, supported by practical examples, is essential to preparing business students for modern, data-informed roles. To illustrate this, a detailed practical example of a retail data management system is included, demonstrating how database principles directly contribute to business performance. Through experiential learning, students not only develop technical competencies but also gain insights into how data underpins strategic thinking and facilitates competitive advantages in today's global market (McKinney & Kroenke, 2018; Nguyen et al., 2021). Case-based learning further reinforces knowledge by placing students in realistic roles that require decision-making and problem-solving (Herreid, 2011). Through such activities, students develop both cognitive and technical skills, including data design, systems thinking, and user experience considerations (Silberschatz et al., 2020).

The case example is a term-long database project for students enrolled in an introductory database management or information systems course. With the addition of increased complexity, the project may also be prepared for students in intermediate/advanced levels of database management, in addition undergraduate or graduate. To complete the project, the student will be exposed to various database development skills. Students will learn to: (1) understand the fundamentals of logical and physical data modeling by developing entity-relationship (ER) diagrams, including normalization; (2) create and populate database tables while applying business rules; and (3) create forms, queries, and reports. This project is designed for any relational database management system (DBMS), such as Microsoft Access, Oracle, Microsoft's SQL Server, or MySQL.

LITERATURE REVIEW

Active and Experiential Learning

Active learning methods such as PBL and case-based instruction have become prominent in engineering and computing education for their effectiveness in fostering deep learning (Michael, 2006; Bonwell & Eison, 1991). Kolb's experiential learning cycle (1984) identifies concrete experience, reflective observation, abstract conceptualization, and active experimentation as essential components, all of which are fulfilled in well-designed real-world projects.

Numerous studies have affirmed that incorporating real-life problems into coursework helps bridge the gap between academic theory and workplace application (Bransford, Brown, & Cocking, 2000; Savery, 2006). In particular, case-based learning supports the development of both procedural and declarative knowledge, encouraging students to engage in inquiry, dialogue, and synthesis (Herreid, 2001; Kim et al., 2006).

Information Systems Pedagogy

Within the field of information systems, hands-on database projects help students internalize key concepts such as normalization, data integrity, and ER modeling (Elmasri & Navathe, 2016; Silberschatz et al., 2020). According to Connolly and Begg (2015), students who work on applied system development tasks show higher mastery of relational design and query optimization. Additionally, peer collaboration in such environments supports social constructivist theories of learning (Vygotsky, 1978).

Recent studies also emphasize the importance of industry alignment in computing education, noting that students with experience in authentic projects are better prepared for real-world challenges (Denning, 2017; ACM/IEEE-CS, 2013). Projects that require user interface development and stakeholder analysis further simulate actual job requirements (Whitten et al., 2004).

CASE EXAMPLE

Gold Rush Antiques is a real-world database management case. Gold Rush is a business with multiple locations across north Georgia which has experienced growth. The scenario engages students in the design and development of a database to advance the organization and analysis of the data. This case is created at various levels of data management coursework – beginning, intermediate, or advanced. The case scenario is written at a beginner level; teaching notes have intermediate and advanced suggestions (provided upon request). Students are requested to develop a working prototype of a database management system that includes the design of data, tables,

forms, queries, and reports. The Gold Rush Antiques case study allows students to not only learn the development of a database but also understand how to examine, analyze, and apply business procedures.

This teaching case is a semester-long team project designed to model an organization's data needs and will design and prototype a database application. The deliverables for the project should be due in several stages at various points throughout the semester. Each team's success will depend on being able to apply many of the course objectives (including data modeling, logical database design, etc.). In this team project, each team will model an organization's data needs and will design a prototype of a database application. Expectations for quality of design, professionalism, appropriate use of entity-relational diagramming techniques and complexity are rigorous. The project will involve the conceptual, logical and physical development of a database system, with a final day for discussion and walk through of each team's efforts. The details of the case requirements and project deliverables are explained in the next sections.

Case Opener

Gold Rush Antiques (aka Gold Rush) is a small and midsize business (SMB) that focuses on antiques and interior shop design located in Buford, Georgia. Gold Rush is a family-owned business of almost 20 years with multiple locations across the north Georgia region. Gold Rush has undergone incredible growth in the last few years with the opening of three (3) more shops in north Georgia (Dahlonega, Alpharetta, and Marietta).

Within each antique shop exists several booths. These booths house various vendors' goods separated based on vendor, product type, and other characteristics. Gold Rush refers to their vendors as "dealers" and within the shop, several different dealers provide goods and services for the customers who visit. The dealers display their products (i.e., antiques) for sale in individual booths within each Gold Rush shop. Dealers rent booth spaces, varying in size from small to large. Gold Rush earns revenue by taking a percentage of each dealer's sales, this covers Gold Rush's payroll for employees and other overhead expenses.

As a small family-owned business, Gold Rush could reach new heights. With the right system in place, Gold Rush has the capability of managing multiple shop locations and increasing sales. To address the tremendous growth and increase in presence, Gold Rush management faces two main challenges: they need to (1) have a centralized system to track the employee and dealer information for multiple shop locations and (2) prepare a sales management system (SMS) to manage sales transactions, booth-information, booth-locations, and product inventory. The growth of the business has been faster than Gold Rush management anticipated and the organization's obsolete method of using hand-written price tags, simple cash register transactions, and Excel spreadsheets is not sufficient to address their business needs (i.e., maintaining dealer and booth information, product data, employee payroll, and sales transactions).

The owner of Gold Rush recognizes the importance of using technology to maintain information and desires a centralized system across all locations to maintain efficiency and effectiveness. Thus,

Gold Rush has chosen to utilize a database management system to maintain data about its employees, dealers, and customers. After interviewing several dealers and employees, the owner of Gold Rush prepared a database requirements report. This report includes business procedures, and the data required in the new system.

Business Procedures & Database Requirements

Gold Rush requires a centralized database that tracks dealers, booth-information at each location, dealer products at each location, to monitor current product inventory levels (quantity on hand, product costs, and selling prices) and sale transactions (by dealer and employee). Forms should be simple and effective to allow users to enter data about the dealers, booths (location, size, etc.), customer information, and dealer products. Reports explore dealer popularity, product information, and revenue. In addition, specific information about employees from the database for payroll purposes needs to be extracted – this may be outside of the current scope but a definite must for future system development.

Current Procedures

Employee

There are four types of employees at each location: cashier, sales associate, loader, and greeter (See Table 1). Employee information maintained includes their name, address, phone, email, employee type, and store. Employee payrate is based on experience and may be increased after a thirty (30) day probation period based on number of hours and performance. Gold Rush's current employee payroll process is based on the honor system. The employees hand writes the hours they work and give the manager each week. Often, they wait until the last day of payroll to document their hours, and this does not always result in an accurate payroll. Additionally, the hours are not confirmed but based on trusting that the employee did in fact work on the days and times stated by them. Gold Rush employs all sales associates; dealers do not hire shop staff and may not have representatives actively selling in booths.

TABLE 1. GOLD RUSH ANTIQUES – SAMPLE EMPLOYEE JOB TITLES INFORMATION

Job Titles	Description
Greeter	Welcome customers to store; verify purchases; stand for a minimum of 4 hours
Inventory Handler	Organizes the inventory in the booths, stocks the inventory
Loader	Some retail experience required; Be able to lift and move furniture
Sales Associate	Some retail experience required with preferred merchandising experience; Effective communication skills necessary

Dealers & Booths

Dealer information is currently stored in excel spreadsheets. The spreadsheet has the dealer's name, address, phone number, and email (See Table 2). Other dealer information is gathered through an application process (e.g., website, social media tags, etc.). The booth type that the dealer has is stored with the dealer information. There are three types of booths: 8 x 10, 10 x 12, and 12 x 14. Each shop location has the same amount of each booth type. The shop layout is the same for each location. Booth rental prices are based on the shop, the exact booth location in each shop, and the size of booth. There are four shop-locales: Alpharetta, Buford, Dahlonega, and Marietta. A dealer may have only one booth at a single locale but may have a booth at multiple shop locales.

TABLE 2. GOLD RUSH ANTIQUES – SAMPLE DEALER INFORMATION EXCEL SPREADSHEET

Name	Address	Email	Phone
Matt Johnson	23 Park Place, Columbus, GA 31909	no3vintage@email.com	(678) 257-1313
Christina Berry	68 Oriental Avenue, Montgomery, AL 36106	brookstone@email.com	(706) 257-5679
James Brown	92 Charles Place, Birmingham, AL 35242	eaglesnest@email.com	(205) 257-3581
Johanna Walker	34 St James Place, Columbus, GA 31909	mypurpose@email.com	(706) 257-6190
Shelley Jones	59 Atlantic Way, Montgomery, AL 36106	greenacres@email.com	(334) 257-5574

A dealer must sign an initial six-month lease which then moves to a month-to-month lease afterwards with a month's deposit. The deposit represents the last month's rent once the dealer has provided a written notice of vacating the premises within the required thirty (30) days. Rent is due at the beginning of each month and may not be deducted from product sales. Gold Rush receives an 8% commission on each sales transaction. There is also a service charge of 4% for all credit card transactions. Each dealer gets a sales payout at the end of each month.

Products

Each dealer may fill their booth with any type of products. However, sixty percent (60%) of products must be considered as antique or vintage and the other forty percent (40%) may be a mix of product types (See Table 3). Each dealer will need to describe their products and explain how they meet these standards in the dealer application form. Additional characteristics of products are also collected (name, price, color, material, type, where type is furniture, pottery, jewelry, etc.). This is a stand-alone form created once the dealer has been approved. This allows the dealer to fill in this form every time updates are made to their inventory. The dealer is responsible for getting the products to the shop and into the booth, but the Gold Rush inventory handler verifies and stocks the products to give a consistent look across the Gold Rush shops. It is the dealer's responsibility to market their booth and products.

TABLE 3. GOLD RUSH ANTIQUES – SAMPLE PRODUCT CATEGORIES INFORMATION

Product Categories
Memorabilia
Vintage Vinyl
Coca Cola
Furniture
Military Antiques
Photography & Paintings
Toys
Pottery
Holiday Items
Jewelry

Dealers may sell as many products as they can fit in the given booth space. Although dealers may sell similar product types, their products are assigned individual product numbers. This is how Gold Rush identifies whose products are purchased. This also allows the creation of reports at the end of the month, generated by Gold Rush, to determine the number of sales per dealer and the Gold Rush commission.

Sales

Currently, each dealer must create their own sales label. These labels contain a description of the product and the price that the dealer is selling it for. When working with many different dealers, it becomes difficult to check customers out because the dealers' labels are difficult to decipher. This upsets the customers at the cash register as the transactions take a long time because the employees cannot clearly read the labels. Sample Customer data is provided in Table 4.

Going forward, Gold Rush would like to implement some standards with respect to its sales process. Creating standard print labels makes it easier to identify the product information and its associated dealer. They do not wish to burden their own staff with attempting to label and manage the information, so a form in which the Dealers can fill out and provide all the pre-identified information is needed. This form and data are collected initially with the application and then each time the dealer wishes to stock more inventory in their booth (weekly or monthly). This will require a system that pre-assigns product numbers and requests any other pre-identified attributes (e.g., standard product type or characteristic list/dropdown). By digitizing and automating these processes, the employees should be able to easily search, scan or enter information upon the sales transaction. After the information is entered, several documents are created: (1) a receipt for the customer, (2) a copy of the receipt for Gold Rush documentation, and (3) a list of products that are picked up at the loading dock for the loaders to prepare.

TABLE 4. GOLD RUSH ANTIQUES – SAMPLE CUSTOMER INFORMATION

Name	Address	City, State, and Zip	Phone
Alenjandro Roller	916 Ridgecrest	Canton, GA 30115	(999) 844-4021
Allan Morgan	1022 Madison Way	Dahlonega, GA 30597	(999) 751-4445
Keisha Moderna	1209 North Avenue	Cartersville, GA 30120	(444) 330-1838
Terry Jones	6721 Bunker Hill Way	Ellijay, GA 30540	(444) 348-1085
Katherine Simmons	46451 Nash Lane	Ellijay, GA 30540	(773) 536-8481
Donny Walker	1190 Meridian	Buford, GA 30519	(312) 337-3822
Ebony Strong	1600 Minnesota Street	Dallas, GA 30157	(272) 285-1386
Henry Westland	3844 Stone Mountain	Dallas, GA 30157	(272) 331-0574
Joseph Keck	4116 Pinnacle Square	Blue Ridge, GA 30513	(555) 715-1988
Jacob Beath	6502 Oak Ridge Ct	Marietta, GA 30067	(312) 335-6232
Lionel Mason	2335 Hiatus Road	Marietta, GA 30067	(888) 212-7958
Leigh Ellen March	5606 Pines Blvd	Blairsville, GA 30721	(999) 307-3629
Montgomery Grant	12013 Hollywood Drive	Alpharetta, GA 30009	(312) 281-3418

Forms Requirements

Administrators and employees at Gold Rush would like to have user-friendly forms to ease the process of entering data related to dealers, customers, products, etc. Input forms, data entry forms, and application forms, complex forms including data from multiple tables, are requested to accomplish their goals.

Input/Query Forms

Various stakeholders desire the ability to enter, edit, or query data. Input forms must include labels consisting of descriptive names that represent the business.

Create Input/Query forms for the following tables:

Remember attributes are developed from the functional requirements mentioned throughout this case
- Employee information
- Dealer information
- Booth information
- Shop information
- Product
- Customer
- Sale information
- Any other associated tables

Application Forms

The information arrives from various stakeholders and application forms may be designed to add new information related to the combined data. These forms may include split forms, simple forms, multiple item forms, and/or navigation forms.

1. **Dealer Entry Form:** This should include the dealer's information and the requested application information.
2. **Product Entry Form:** List the project name and characteristics labeled in the functional requirements. Don't forget to assign a unique identifier for each product within each product category.
3. **Transaction Forms:** This is your sales transaction. As the cashier is checking the customer out, they need to collect information related to the sales transaction. Display the employee ID, date, time, sales transaction number, product purchases for that transaction along with the dealer for each product, and any other additional information related to the sales transaction.

Queries Requirements

A variety of queries are required to extract meaningful and accurate data. For Gold Rush management and staff to be more efficient and effective with their customers, packaging and logistics, data must be extracted and filtered to answer fundamental and essential questions. We have determined that the initial queries to be included in the database are below.

All query column headings are to be clear, concise, and accurately describe the contents of the column to the average user. Only universally accepted abbreviations are to be used. The queries are to be named as they are listed below.

1. **Dealer List:** List Dealer First and Last Name, Address (all parts), phone, email, webpage, and social media tag.
2. **Dealer-Booth List by Shop:** List each Shop with their corresponding booth types and dealers who currently rent.
3. **Booth Availability:** List all booths by shop that are currently available (not rented). Be certain to include their size and fee.
4. **Product List by Booth:** List booth ID, product ID, product name, product type, quantity on hand, and price. Format price as currency. The result should be sorted in ascending order by name.
5. **Customer Product Statistics:** Display customer name, product price, revenue, and total amount of each transaction (including tax). Format the necessary columns as currency.
6. **Product Margin:** Display by month the Location, Product Price, Product Cost, Total Product Margin (cost/price). Note: Product Margins are generally displayed in percentages.
7. **Dealer Monthly Sales:** Display the month, location, dealer information, total sales, and monthly commission.
8. **Shop Sales:** Display total sales by shop. Show shops, city, and total sales. Sort by shop.

Reports

Gold Rush requires several reports for the management team to analyze. The report requirements appear below. Label all sub-totals and grand totals appropriately with user-friendly descriptions to the left of the totals. Finally, to provide a more detailed and accurate appearance, all sub-totals should have a line above the subtotal and the grand total should have a double line above the total.

1. **Dealer Reports:**
   a) **Product Sales by Category:** This report provides a list of sales transactions based on categories over weeks/months by Dealer. Display the Dealer and their product sales by category. Total columns represented are Total Sales by Product, Total Product Per Category, and Total Sales by Product Category.
   b) **Dealer Monthly (or Annual) Fees** This report highlights for the Dealer the costs/fees they are incurring each month (or year). Representing their monthly payments to Gold Rush and the percentage that Gold Rush charges for the sales conducted. Display the Dealer Name, Address Information, Email, and monthly charges for renting booth(s) and percentage taken from each sales transaction grouped by month. Total columns for month (and/or year).
2. **Booth Rental Status Report:** This report highlights the various booth rentals among the dealers at each store. Gold Rush would like to understand who rents a booth at which stores during each month. Display at minimum the Dealer Name, booths rented, fees collected for each booth, and among which stores. Group by Booth Size and then Store.
3. **Daily Detailed Revenue Report:** This report is based on the Daily Revenue. Display the Transaction Date, Location, Total Product Cost, Total Product Revenue (quantity * price), and Total Revenue (Product Revenue – Product Costs). Group by Transaction Date and Location. Provide totals of the Revenue by Location and the full report.
4. **Gold Rush Receipt:** The form allows the employee or customer to review their transaction purchase prior to finally submitting payment. This form is like a receipt and is to be formatted in columnar format. The display of transaction and payment information should include the following fields: Purchase Date, Transaction ID, Product Number, Product Name, Quantity, Price, Amount, Subtotal, Sales Tax, and Total Amount Due. The Subtotal, Sales Tax Amount, and Total Amount Due should be calculated fields based on amount and shipping fee totals. Recall, the sales tax rate is 8%.

DELIVERABLES

Milestone One

Milestone One includes the following:

1. Write an executive summary. This should be a 1–2 pages project overview. It should briefly describe the initial analysis of the business scenario provided as it pertains to designing a

database application. It should communicate clearly what it is you think the system you intend to develop will do in terms of specific functionality that your final product will offer. The executive summary should be as detailed as possible. Some assumptions may be made (in the early phases it is often the case that some things are a little fuzzy), but these must be reasonable and defensible within the context of the Gold Rush scenario. The customer is not a technical person so there should be little to no technical jargon that may confuse them.

2. Create an entity-relationship diagram (ERD). Provide a conceptual data model for your proposed system using a suitable graphical modeling representation. Use any tool you choose to create the ERD. Normalization is a necessary process to ensure that all tables and fields meet integrity requirements, reduce redundancy, and ensure a well-structured database. Final ERD diagrams should be in third-normal form with no transitive or functional dependencies. All attributes of the entities must be shown using appropriate notation. Attributes that serve as identifiers must be underlined. Be sure to list all business rules and other assumptions.

3. Create a database structure. Show all relevant entities and their relationships, including the cardinalities of the relationships and participation requirements set by the Gold Rush Antiques scenario. Appropriate field names, data types, and field sizes should be used for all tables as described in the scenario.

4. Populate all tables with the sample data contained in the Gold Rush Antiques scenario (see Appendix) and any additional data provided by your instructor.

Milestone Two

Milestone Two includes the following:

1. Make corrections based on instructor feedback from Milestone One.
2. Review case study instructions for forms, queries, and reports. Create all needed forms, queries, and reports.
3. Create a simple logo for Gold Rush Antiques and incorporate in your forms and reports.
4. Navigational menu using the Switchboard Manager (advanced option).

Milestone Three

Milestone Three includes the following:

Develop your final prototype and written report.

1. Submit the completed prototype that illustrates your implementation of the work you have completed in prior milestones.
2. Demonstrate your command of tables, forms, queries, and reports, using whatever features are available in your given DBMS tool to make your prototype professional-looking and

functional. You can be as creative and ambitious as you wish. However, temper your creativity with the realization that a modest application that works well is better than a flashy one that crashes.

3. Submit documentation representing the creation of your prototype (e.g., database, SQL code, screenshots of forms, queries, reports, navigation menu, etc.).
4. Create a formal, professional group presentation demonstrating your prototype. It should be well organized and rehearsed. You must be prepared to address the overall scope and functionality of your project.

Case Conclusion

Gold Rush requires assistance. As the business has expanded, the demands and workload have increased. Gold Rush's decision to modernize its sales and inventory processes with a database will improve organization and profitability. Management is relying on your expertise to apply data management skills to address their business needs.

CONCLUSION

In contemporary education, passive lecture formats are increasingly insufficient to prepare students for the complexities of real-world data environments. Instead, educators are turning toward active learning frameworks that integrate practical application into theoretical instruction (Prince, 2004). The use of a real-world case study transforms the learning environment from passive reception to active construction of knowledge. As Dewey (1938) argued, education must be grounded in experience to be meaningful. The case study above allows students to *learn by doing* and practice problem-solving skills in a real-world context (Connolly & Begg, 2006). Gold Rush addresses the gap highlighted by Slonka and Bhatnagar (2024) that the design of relational databases is a difficult concept for students, especially with no previous or limited experience in design modeling. We strive to provide skillsets that (1) reinforce theoretical concepts learned in a database management course, (2) learn and perform critical thinking in determining end-user requirements and information necessary for data flow and entity relationship diagrams, and (3) practical experience in database development, including forms, queries, and reports. Hence, we highlight how classroom lectures are enhanced by the experience and application of a real-world project-based case study (Børte et al., 2023).

In conclusion, teaching database design to business students is not merely beneficial—it is crucial in the context of modern business operations. As companies increasingly rely on data for decision-making, the ability of business professionals to understand and work with data structures becomes indispensable (Kustitskaya et al., 2023). This case study has illustrated that incorporating database education into business curricula fosters analytical thinking, supports interdisciplinary collaboration, and enhances employability (Loyens et al., 2023). Ultimately, embedding database design principles into business education bridges the gap between theory and application, empowering students to leverage data as a strategic asset in their future careers (Rob & Coronel,

2019; Valacich & Schneider, 2017). As the demand for data-savvy business professionals continues to grow, academic institutions must adapt by prioritizing database competencies within business programs.

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