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A Framework for Teaching Data Warehousing Using SAP Datasphere

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Abstract

The rapid adoption of cloud computing, artificial intelligence (AI), and enterprise analytics has increased the need for information systems students to understand modern data warehousing concepts and apply them in intelligent enterprise environments. This paper presents a project-based teaching framework for integrating SAP Datasphere into data warehousing education. As part of the SAP Business Technology Platform (BTP), SAP Datasphere provides a cloud-based environment for data integration, transformation, semantic modeling, governance, and analytical consumption. The proposed framework combines foundational concepts—including dimensional modeling, star schemas, fact and dimension tables, data quality, data integration, and semantic layers—with hands-on activities conducted in an enterprise cloud environment. Using business sales scenarios, students design and implement a data warehouse, develop graphical and SQL-based data models, define business entities and analytical measures, and connect their models to SAP Analytics Cloud for visualization and decision support. Students then extend their projects by developing AI applications and generating AI-assisted business insights within the broader SAP BTP ecosystem. The paper describes the project design, learning objectives, instructional modules, timelines, and assessment strategies. The project framework illustrates how SAP Datasphere can bridge data warehousing theory and contemporary enterprise practice while preparing students for careers in data engineering, business intelligence, enterprise analytics, and AI-enabled enterprise systems. This framework was developed for the SAP Datasphere project case. The project was implemented by information systems students in eight weeks. One student team project was presented, demonstrated, and awarded at an Annual Analytics Symposium, which was collaboratively organized by the 11 networked national institutions in the summer of 2025. The project framework can be utilized in data warehousing, data analytics, and business intelligence courses in information systems education.

Keywords: Information Systems Curriculum, Data Warehousing Education, SAP Datasphere, Experiential Learning, Information Systems Education, SAP Business Technology Platform (BTP)

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1. INTRODUCTION

Data warehousing is a critical enterprise technology adopted by an increasing number of organizations to support analytics and data-driven decision-making. Incorporating data warehousing into the information systems (IS) curriculum, particularly through hands-on experience with industry-standard software, can better prepare students to become the next generation of digital business leaders. This paper provides IS educators with an alternative approach to teaching advanced data warehousing technologies, concepts, and skills using SAP Datasphere.

To align instruction with evolving industry practices and the growing influence of artificial intelligence (AI), the author incorporated SAP Datasphere into student data warehousing projects, using curriculum materials provided by SAP University Alliances (UA). These materials are available through the SAP UA Learning Portal (SAP SE 2025). SAP Datasphere is a cloud-based software-as-a-service solution that evolved from SAP Business Warehouse (BW) and is an important component of SAP Business Data Cloud. It integrates and transforms data from multiple sources into trusted, business-ready information for analytics, planning, and decision support.

The paper presents the rationale, instructional framework, and delivery model for integrating SAP Datasphere into a data warehousing course. The proposed framework addresses data warehouse architecture, system components, data storage, data integration, dimensional and semantic modeling, and implementation. Through hands-on activities, students design and implement a modern data warehousing solution in a real-world, cloud-based enterprise environment. This experiential approach enables students to connect theoretical concepts with contemporary professional practice.

This paper proposes a framework for teaching SAP Datasphere on the SAP Business Technology Platform (BTP), illustrates the delivery of its instructional modules and timelines, and presents an assessment strategy for evaluating student learning outcomes. This framework was developed for the SAP Datasphere project case. The project was implemented by information systems students in eight weeks. One student team project was presented, demonstrated, and awarded at an Annual Analytics Symposium, which was collaboratively organized by the 11 networked national institutions in the summer of 2025. The project framework can be utilized in data warehousing, data analytics, and business intelligence courses in information systems education.

2. BACKGROUND

SAP Datasphere is a data management and integration solution that enables organizations to build a data fabric through semantic modeling, integration, and governance. SAP Datasphere differs from traditional on-premises data warehouses through its cloud-native business data fabric architecture on the SAP Business Technology Platform (BTP). Whereas conventional data warehouse environments typically rely on extensive extract, transform, and load (ETL) processes and centralized data storage, SAP Datasphere supports data federation, semantic modeling, and the preservation of business context across distributed SAP and non-SAP data sources. These capabilities provide scalable and governed access to trusted, AI-ready enterprise data while reducing unnecessary data duplication and simplifying integration across hybrid and multi-cloud environments. Within the SAP BTP ecosystem, SAP Datasphere provides a unified and semantically rich view of enterprise data.

As the successor to SAP Data Warehouse Cloud, SAP Datasphere is a software-as-a-service (SaaS) solution and a core component of SAP Business Data Cloud. An important instructional focus of this course is understanding SAP Datasphere's distinct role within the broader analytics landscape. SAP Datasphere provides the governed data foundation and semantic business layer, while downstream analytical, planning, and AI applications consume this trusted data to generate insights and support

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business processes. Figure 1 illustrates the Core SAP Datasphere Process (Source: the screenshot from the 2025 SAP UA Bootcamp learning materials).

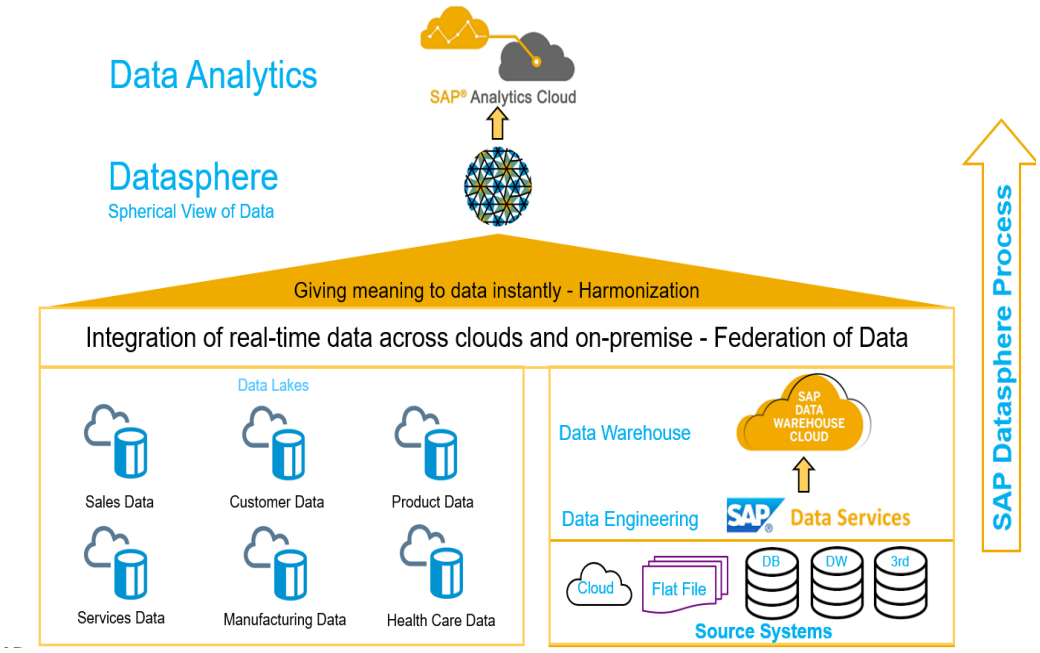

Figure 1. SAP Datasphere Process

Teaching SAP Datasphere exposes students to contemporary cloud-based data management paradigms, including data fabric architecture, semantic data modeling, data virtualization, and AI-ready analytics. These concepts represent a significant advancement beyond the traditional extract-transform-load (ETL)-centric data warehousing approaches commonly taught in information systems curricula. Through hands-on experience with SAP Datasphere and related technologies, students gain practical knowledge of modern enterprise data ecosystems and learn how organizations transform disparate data sources into trusted, business-ready information assets.

The principal technologies used in the course include SAP Datasphere: data integration, transformation, modeling, governance, and semantic management. SAP Business Technology Platform (SAP BTP): The underlying cloud platform that supports data management, analytics, application development, integration, automation, and AI services.

SAP Analytics Cloud (SAC): Dashboard development, data visualization, planning, reporting, and analytical consumption. Source Systems: SAP and non-SAP operational systems, databases, flat files, data lakes, and APIs that provide enterprise data for analysis.

SAP Datasphere is SAP's cloud-based data management and data warehousing platform. It enables organizations to connect, integrate, model, govern, and analyze data from both SAP and non-SAP environments while preserving the business context and meaning of the underlying data. By integrating data from multiple sources into a unified semantic layer, SAP Datasphere transforms raw data into trusted, business-ready information that supports analytics, planning, and decision-making. Figure 2 illustrates the data flow and architectural relationships within the SAP Datasphere technology environment. In Figure 2, BW stands for Business Warehouse. Figure 2 illustrates SAP Datasphere as SAP's enterprise data warehousing and analytics platform for collecting, integrating, storing, analyzing, and visualizing SAP data (Source: the screenshot from the 2025 SAP UA Bootcamp learning materials).

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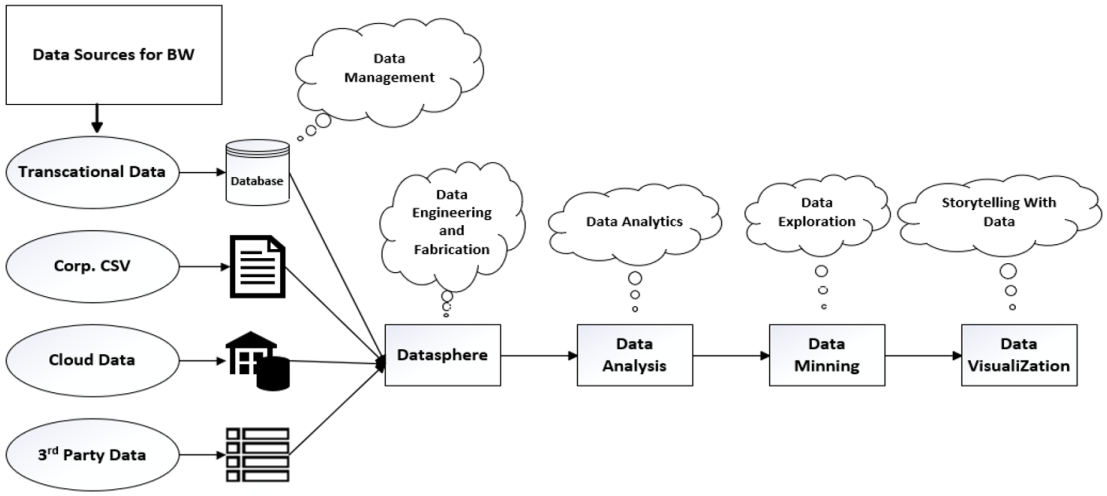

Figure 2. Data Flow in SAP Datasphere Technology Environment

3. LITERATURE REVIEW

Enterprise data warehousing remains a critical component of information systems education because it integrates database management, business processes, analytics, and managerial decision making. Unlike transaction processing systems, which are designed to capture routine business transactions, data warehouses consolidate historical data from multiple operational systems to support reporting, multidimensional analysis, and strategic decision making. Traditional data warehousing instruction focuses on core topics such as data extraction, transformation, and loading (ETL); dimensional modeling; data quality management; metadata; and analytical reporting.

Dimensional modeling serves as a foundational concept in many data warehousing curricula. In this approach, measurable business events are stored in fact tables and connected to descriptive dimensions such as customer, product, location, and time (Kimball & Ross, 2013). The star schema provides an intuitive structure that enables students to link database design concepts directly to business questions and analytical requirements. As a result, dimensional modeling helps students understand how data can be organized to support decision-making and performance analysis.

Research on enterprise data warehousing further highlights the importance of competencies that extend beyond technical design. Drawing on data from 111 organizations, Wixom and Watson (2001) found that both system quality and data quality significantly influence the perceived benefits of data warehouse implementations. Their study also identified management support, organizational resources, user participation, and skilled project teams as critical success factors. These findings suggest that data warehousing education should address organizational, managerial, and governance considerations in addition to technical concepts. Students must recognize that even a well-designed analytical schema may fail to deliver value if the source data is unreliable, the business definitions are inconsistent, or the key users are not actively involved in the development process (Wixom & Watson, 2001).

3.1 Data Warehousing and Business Intelligence Education

The integration of technical skills and organizational knowledge aligns with the IS2020 Competency Model (Leidig et al., 2021), which identifies data and information management, data and business analytics, and data visualization as distinct yet interconnected competency areas. The model also emphasizes integrating knowledge, skills, and dispositions into observable professional performance. Therefore, a data warehousing course should extend beyond declarative knowledge by requiring students to design data models, use contemporary technologies, interpret analytical results, and communicate evidence-based business recommendations (Leidig et al., 2021).

3.2 Experiential Learning in Data Warehousing

Experiential learning provides an appropriate pedagogical foundation for developing these integrated competencies. Kolb (1984) conceptualizes learning as a cycle comprising concrete experience, reflective observation, abstract conceptualization, and active experimentation. In a data warehousing course, students can engage in this cycle by translating business problems into dimensional models, implementing and testing those models through analytical queries, reflecting on design challenges, and revising their solutions.

Gottipati & Shankararaman (2016) applied experiential learning principles to the design of a data warehousing and business analytics course that combined classroom instruction with projects provided by external organizations. Students acquired conceptual knowledge and technical skills and then applied them to authentic organizational problems, with instructors and industry partners participating in mentoring and assessment. Their findings suggest that authentic projects can help students understand the relationships among business requirements, data preparation, analytical modeling, and organizational value.

Simulation provides another approach to creating authentic learning experiences. Mannino et al. (2021) developed the Emerge2Maturity simulation to teach organizational development in data warehousing. Rather than focusing exclusively on schema design, the simulation exposes students to resource constraints, capability development, organizational learning, external events, and cost–benefit trade-offs. Its preliminary evaluation demonstrated the potential of simulation and structured debriefing to improve students' understanding of data warehouse maturity. This research suggests that students benefit from experiencing data warehousing as an evolving organizational capability rather than simply as a database assignment.

Pedagogical research studies have been conducted in BI courses using multiple tools in recent years. Shi, et al., (2024) introduced a report-oriented pedagogical method in BI courses. They compared Problem-based learning (PBL) and case-based learning (CBL), which have long been used in BI courses, with report-oriented learning (ROL), which uses Excel, Access, and Google Analytics. Mitri (2023), who utilized Amazon Web Services (AWS) DynamoDB in the BI course for students using Python and AWS for NoSQL to manipulate/query in a relational environment. The results indicate that the method was effective and that students perceived it as improving their critical thinking and practical skills in applying BI techniques.

More directly related to SAP-supported education, Wang et al. (2024) introduced a modular framework that integrates SAP business processes, ERPsim, and SAP data warehousing into an undergraduate business data analytics course. Its implementation in both virtual and face-to-face environments was associated with improvements in students' learning experiences and overall teaching effectiveness. The study demonstrates how enterprise systems and simulation-generated data can support a continuous learning environment in which students generate transactional data, integrate the data into a warehouse, and analyze organizational performance. The present study extends this line of research from earlier SAP data warehouse environments to the cloud-based data integration, modeling, and analytics capabilities of SAP Datasphere and SAP BTP.

3.3 Cloud Platforms and SAP Datasphere

The transition from on-premises data warehouses to cloud data platforms changes both professional practice and educational requirements. Contemporary data professionals must understand data federation, virtualization, cloud connectivity, semantic modeling, governance, and the integration of SAP and non-SAP sources. Teaching only local relational databases and manually constructed extract-transform-load processes may therefore provide insufficient exposure to current enterprise architectures.

SAP Business Technology Platform (SAP BTP) is SAP's cloud-based platform-as-a-service (PaaS) environment that unifies capabilities across data and analytics, artificial intelligence, application development, automation, and integration. It enables organizations to build, extend, and integrate applications while providing a common foundation for data-driven digital transformation initiatives. SAP Datasphere operates as a key data management component within SAP BTP, supporting data integration, semantic modeling, governance, and analytics across hybrid and multi-cloud environments. Figure 3

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illustrates the components of SAP BTP as an intelligent enterprise platform (Source: the screenshot from the 2025 SAP UA Bootcamp learning materials).

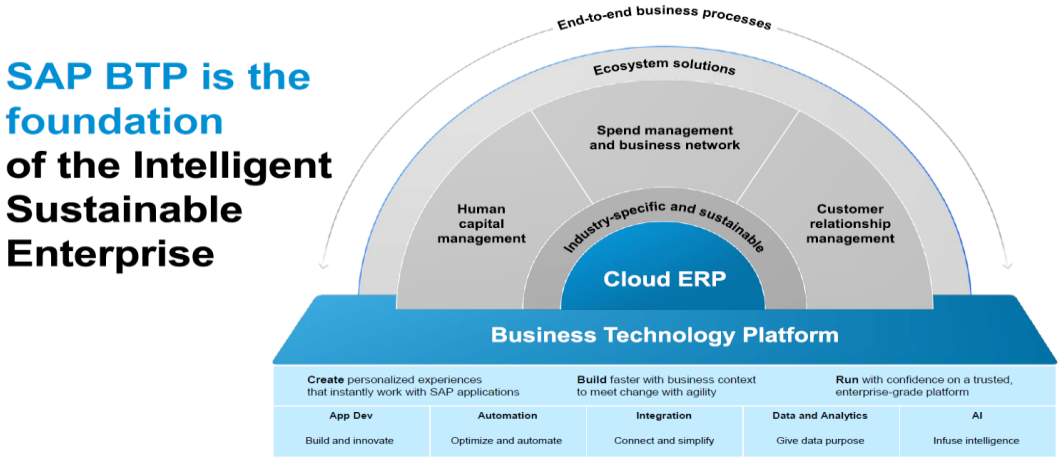

Figure 3. SAP Business Technology Platform with AI automation

Komarina, G. B., & Sajja, J. W. (2025) explored four key aspects: BTP's unified data platform architecture, its integration capabilities and data management excellence, advanced analytics and intelligence services, and strategic business impact. BTP serves as a crucial integration layer that connects disparate data sources while enabling advanced analytics and artificial intelligence capabilities.

3.4 AI-enabled Enterprise Analytics

The growing use of artificial intelligence adds a new dimension to data warehousing education. AI systems depend on accessible, reliable, semantically meaningful, and appropriately governed data in the enterprise system. Data warehousing is therefore not displaced by AI; instead, its role becomes more important because poor-quality or poorly contextualized enterprise data can produce inaccurate or misleading AI-supported outputs. Therefore, students should understand data warehousing as a foundation for responsible enterprise AI.

Within the SAP ecosystem, AI capabilities are increasingly incorporated through SAP BTP and Joule. SAP Joule uses generative AI to interpret requests, retrieve information, support navigation, and perform certain tasks in a conversational manner. Embedded Joule capabilities in SAP Datasphere can support informational, navigational, and transactional interactions, including explanations of product functionality and selected actions within a Datasphere environment. These developments provide opportunities for students to examine how natural-language interfaces may change data query, data engineering, and analytical work.

Educational literature nevertheless recommends cautious and purposeful AI integration. Noroozi et al. (2024) conclude that generative AI can provide personalized feedback, increase engagement, and support learning and research activities, but they also identify risks involving accuracy, privacy, bias, contextual limitations, academic integrity, and diminished critical thinking. They emphasize the continuing need for ethical guidance and human oversight (Noroozi et al., 2024). Accordingly, AI activities using SAP Datasphere in the data warehousing course should require students to verify the generated recommendations against the source data, document their prompts and validation processes, identify potential errors, and independently explain the underlying model.

3.5 Research gap and study contribution

Existing literature supports important conclusions. First, data warehousing education should integrate technical modeling, data quality, organizational context, and analytical communication. Second, experiential projects, simulations, and enterprise platforms can improve students' ability to connect theoretical concepts with professional practice. Third, generative AI creates valuable educational opportunities but also increases the need for verification, governance, and authentic assessment.

Peer-reviewed research has examined how SAP Datasphere can be systematically incorporated into data warehousing education. Prior studies address experiential data warehousing courses, simulations, and earlier SAP-supported business analytics environments, but they do not fully explain how students can learn cloud integration, semantic modeling, analytical consumption, and AI-supported interaction using SAP Datasphere on SAP BTP. This gap supports the development and evaluation of a teaching framework that integrates foundational dimensional modeling with cloud data management, SAP Datasphere, and responsible use of AI. Such a framework could contribute both a replicable instructional design and empirical evidence concerning student learning, self-efficacy, technology acceptance, and perceived career relevance.

4. TEACHING FRAMEWORK

The author proposes teaching the SAP Datasphere framework outlined in Table 1, based on her teaching experience in this area. It takes one week to teach each topic in the framework. The assumption is that students have already learned the prerequisite database knowledge and skills.

Module	Data Warehouse Concepts	SAP Datasphere Activity
Data Warehouse foundation	OLTP versus OLAP and architecture	Explore the GBI Case in the SAP Datasphere environment
Dimensional modeling	Facts, dimensions, measures, & modeling	Develop sales star/snowflake schemas
Data integration	Data connections and replication	Import or connect operational datasets
Data transformation	Cleansing, joins, and calculated fields	Create entities, or SQL-based views
Semantic modeling	Entities, measures, associations & hierarchies	Define measures, attributes, and hierarchies
Analytics	dashboards, views, and data drill-down	Connect the model to SAP Analytics Cloud
Governance	Security, access control, and data quality	Configure spaces and data-access controls
AI-enabled analytics	AI assistance and prediction	Develop query & analytics using AI Chat GPT

Table 1. Teaching Data Warehousing with SAP Datasphere Framework

Learning Objectives

After completing the learning modules, students should be able to:

1. Explain modern data warehouse architecture.
2. Differentiate operational and analytical data systems.
3. Design a dimensional model using facts, dimensions, measures, and hierarchies.
4. Construct star and snowflake schemas in SAP Datasphere.
5. Integrate and transform data from multiple sources.
6. Develop semantic models that preserve business meaning.
7. Connect and develop analytical dashboards using SAP Analytics Cloud.
8. Apply data governance, security, and access controls.
9. Apply AI-assisted capabilities appropriately in an analytical workflow.

SAP's current workflow supports creating an analytic model from a prepared fact entity and consuming it in SAP Analytics Cloud.

Student Project

Students could complete a sales distribution project based on a fictional multinational retailer. The company wants to analyze sales performance by product, customer, store, geographic region, and time.

The project would require students to:

- Analyze business requirements.
- Identify the grain of the fact table.
- Design a dimensional model.
- Create time, date, product, customer, store, and geographic dimension.
- Integrate sales and master data.

- Develop calculated measures and key performance indicators.
- Build a governed analytical model.
- Create an executive dashboard.
- Use appropriate AI or predictive capability.
- Present managerial recommendations and discuss limitations.

Sample Student Sales Distribution Project
Students could develop a sales warehouse according to their interests, based on the implementation of the given Global Bike (GBI) case study, containing:

- FactSales: quantity, revenue, cost, discount, and profit
- DimProduct: product, category, and brand
- DimCustomer: customer, segment, and location
- DimStore: store, region, and manager
- DimDate: day, month, quarter, and year

SAP Datasphere Project Contents, Timelines, and Assessment
Assessment should evaluate both students' conceptual understanding and their ability to use SAP Datasphere effectively. A high-performing dashboard alone should not receive a high score if it is built on a poorly designed dimensional model. The complete project is worth 100 points, with the grading distribution summarized in Table 2. The instructional materials, including lecture slides and laboratory exercises, were provided through the SAP 2025 Faculty Datasphere Boot Camp. Student access to SAP Datasphere was provided by the SAP UA Hosting Center.

Global Bike Inc. (GBI) Case Implementation as a template in Datasphere	Week 1	15%
Students' own project conceptual design by modifying JSON codes in GBI	Week 2	10%
Students' own project implementation in Datasphere	Week 3	15%
Illustrating project data integration and transformation in Datasphere	Week 4	10%
Evaluating semantic and analytical models for students' sales project	Week 5	15%
Student project implementation on the SAP Analytics Cloud dashboard	Week 6	15%
Connecting the project data to the ChatGPT Interface for data queries	Week 7	10%
Final Project report and presentation	Week 8	10%

Table 2. Datasphere Project Contents, Timelines, and Assessment

5. CONCLUSION

This study presents a replicable framework for integrating SAP Datasphere into data warehousing education. The framework connects foundational concepts, including data architecture, dimensional modeling, data integration, transformation, semantic modeling, and governance—with hands-on activities in a contemporary cloud-based enterprise environment. By linking these concepts to SAP Analytics Cloud and AI-supported analysis, the framework enables students to experience the complete analytical lifecycle, from preparing and modeling data to developing dashboards and communicating managerial insights.

The framework's principal contribution is its integration of technical, analytical, and managerial learning. Students are expected not only to construct functional data models and analytical applications but also to evaluate data quality, preserve business meaning, apply governance principles, and interpret results in an organizational context. AI is incorporated as a supportive analytical capability rather than a substitute for foundational knowledge. Students must validate AI-generated outputs against trusted data, identify possible errors, and explain the underlying data structures and analytical logic.

The proposed teaching framework provides IS educators with a replicable approach to teaching cloud-based data warehousing. It introduces AI-enabled analytics without allowing AI tools to replace students' understanding of data integration, dimensional modeling, semantic relationships, data quality, and governance. Students are expected to validate AI-generated results against trusted data, evaluate their accuracy, and explain the underlying data structures and analytical logic.

Within this framework, SAP Datasphere serves not merely as a software application but as an experiential learning environment for teaching the complete data warehousing lifecycle. By connecting academic theory with contemporary enterprise practices, the framework prepares students to integrate data, construct analytical models, communicate business insights, and use AI responsibly within an intelligent enterprise environment.

The SAP Datasphere on the BTP enterprise platform offers several pedagogical advantages:

1. Cloud-based access with minimal infrastructure setup
2. Exposure to an enterprise-grade SAP data platform
3. Support for both traditional data warehousing and modern business data fabric concepts
4. Strong semantic modeling capabilities for business-oriented analytics
5. Integration with SAP Analytics Cloud for visualization, reporting, and decision support
6. Opportunities to explore AI-enabled analytics while maintaining an emphasis on trusted data, governance, and foundational data warehousing knowledge

6. LIMITATIONS AND FURTHER RESEARCH

The study's limitations, along with the rationale for the vendor dependency, are clearly explained and summarized in this section. The author outlines a plan for future implementation and further research. Such research can determine how effectively cloud-based enterprise platforms prepare students for emerging professional roles in data engineering, business analytics, and data warehousing.

6.1. Empirical Limitations and Future Assessments

Although the initial implementation was limited by a small sample, the framework provides a foundation for broader empirical evaluation. The scope of the study is limited to the student project implementation in summer 2025. There was insufficient empirical evidence because the sample size was too small to achieve statistical significance. Future Assessments across multiple courses and institutions should examine their effects on student learning, self-efficacy, technology acceptance, responsible use of AI, and perceived career relevance.

6.2 SAP Professional Certification

Future research will also focus on the SAP Professional Data Engineer in SAP BW/4HANA Certification (SAP Learning Journey 2026 and SAP Learning Hub Portal 2026) to help students become business analysts, data scientists, and database/data warehouse professionals for their career development. The certification verifies that students possess the core skills required for the role of a Data Engineer in the SAP enterprise system. Certification will be free and optional for students enrolled in the SAP UA member institutions.

SAP Learning Journey is SAP's structured, role-based learning path that helps learners gain skills in specific SAP products and prepare students for SAP professional certifications. It is free and self-paced online learning with clearly defined learning steps. Includes learning content, practice activities, and certification preparation resources. Content is regularly updated to reflect current SAP technologies and best practices. SAP Learning Journey covers SAP professional certification topics such as:

- SAP Datasphere
- SAP Analytics Cloud (SAC)
- SAP Business Technology Platform (BTP)
- SAP Analytics Cloud (SAC)
- SAP BW/4HANA

6.3 Platform Justification

There are many data warehousing products/tools on the current market. All of them are vendor-dependent. SAP Datasphere is not an exception. The reasons for choosing SAP Datasphere for the data warehousing project are that: 1) trusted integrated data sets are analyzed in the enterprise environment, and 2) insight into the enterprise system is revealed to students.

SAP Datasphere is an important component of the SAP Business Technology Platform (BTP) for enterprise data management and analytics. Datasphere enables organizations to maintain data consistency, enhance decision-making, and achieve a competitive advantage in increasingly data-driven markets by leveraging the SAP data fabric. By learning about the Datasphere in BTP, students can understand the infrastructure, fundamentals, and integrated business processes of enterprise systems.

6. ACKNOWLEDGMENT

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