# CHAPTER 4: SOFTWARE DESIGN

## Design Overview

The design of the DataBridge Education system follows a modular approach, focusing on a star schema architecture to facilitate efficient data management and analysis. The system is divided into multiple components to handle data ingestion, storage, and retrieval effectively.

## System Architecture

The system architecture consists of the following key components:  
- Data Sources: Various educational data sources including student records, attendance logs, and grades.  
- ETL Processes: Managed through SQL Server Integration Services (SSIS) for data extraction, transformation, and loading.  
- Data Warehouse: Implemented using SQL Server with a star schema design, containing fact and dimension tables.  
- Business Intelligence Layer: Power BI for data visualization and reporting, allowing users to create interactive dashboards.

## Data Model

- Star Schema Design: The data warehouse employs a star schema architecture with the following key tables:  
- Fact Table: Stores metrics such as student grades, attendance percentages, and activity participation.  
- Dimension Tables:  
 - Students Dimension: Contains student details including student\_id, name, date\_of\_birth, and enrollment\_date.  
 - Teachers Dimension: Includes teacher information such as teacher\_id, name, and subjects\_taught.  
 - Classes Dimension: Contains information about classes, including class\_id, class\_name, and number\_of\_students.  
 - Time Dimension: Provides temporal data with time\_id, date, and related attributes.

## User Interface Design

The user interface will focus on simplicity and ease of use, allowing users to navigate through data visualizations and reports effortlessly. Key UI components include:  
- Dashboard: A central dashboard displaying key metrics and KPIs.  
- Report Generation: Users can generate reports based on various criteria and filters.

## Assumptions and Constraints

The design assumes that all data sources are accessible and formatted correctly for ETL processes. Performance constraints will be considered to ensure timely data retrieval and processing.

# CHAPTER 5: SYSTEM IMPLEMENTATION & VALIDATION

## Implementation Overview

The implementation of the DataBridge Education system involved several key steps:  
1. Database Creation: Developed a SQL Server database using the star schema design.  
2. ETL Processes: Utilized SQL Server Integration Services (SSIS) to extract, transform, and load educational data into the data warehouse.  
3. Data Loading: Ensured data integrity and consistency during the loading process, with regular checks for errors.

## Validation

Validation of the system was conducted through:  
- Testing: Performed unit tests on ETL processes to ensure accurate data transformation and loading.  
- Performance Evaluation: Assessed query performance to verify that response times met the specified requirements.  
- User Acceptance Testing: Engaged users to evaluate the functionality of Power BI reports and dashboards.

# CHAPTER 6: CONCLUSION & FUTURE WORK

## Conclusion

The DataBridge Education project successfully established a robust data warehousing system tailored for educational data analysis. By implementing a star schema design and utilizing SQL Server Integration Services (SSIS) for ETL processes, the project achieved its objectives of data integrity and efficient reporting. The integration with Power BI provided stakeholders with valuable insights, enabling data-driven decision-making within the educational sector.

## Future Work

Future enhancements for the DataBridge Education system may include:  
- Scalability Improvements: Expanding the system to accommodate larger datasets and more complex analyses.  
- Advanced Analytics: Incorporating machine learning techniques for predictive analytics to further enhance decision-making capabilities.  
- User Interface Upgrades: Improving the user interface based on feedback from users to enhance usability and accessibility.  
- Real-time Data Processing: Exploring options for real-time data integration and reporting to provide up-to-date insights.

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2. Figure 2: Example of ETL Process.

3. Figure 3: Power BI Dashboard Example.

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1. Table 1: Summary of Data Sources.

2. Table 2: Dimensions and Measures in the Data Warehouse.

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