

# Design and Implementation of an Enterprise Integrated Project Environment: Experience from an Information Systems Program

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**Abstract**— Real world information technology projects cut across multiple business domains and processes, involve large amounts of data and an assortment of different technologies. Advanced courses within an IS programs must include projects that help students gain a holistic view of an enterprise by exposing them to business domains, business processes and technical knowledge and skills that will help them design and deliver enterprise projects. In order to guide the instructor to effectively design and implement such enterprise project experiences, in this paper, we propose an enterprise integrated project environment (EIPE) framework based on business domains and business processes. Additionally, we share our experience in implementing this framework in the Data Warehousing and Business Analytics course. The analysis of the student feedback for this course demonstrates the benefits of EIPE in enhancing student learning experience. We share the project details and challenges and discuss our findings and lessons learnt in designing and implementing EIPE. Thus providing one pathway for Information Systems professors to, design an enterprise integrated project in their courses.

**Keywords**—Enterprise projects, Information Systems, Integrated projects, Large scale projects, Design framework

## I. INTRODUCTION

Project-based learning (PBL) PBL can be defined as “a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured among complex, authentic questions and carefully designed projects and task” [9]. The benefits of PBL, the design and implementation methodologies, and challenges are well studied [7, 8, 9].

With the 21st century enterprise demands, information technology projects cut across multiple business functional units and processes, involve large amounts of data, complex problems, and an assortment of different technologies. Therefore, an information systems graduate is required to possess knowledge of business domains, business processes, technical knowledge and skills that are aligned with complex enterprise projects [15, 16].

When designing advanced courses in an information systems program it is, therefore necessary to train students in complex enterprise projects that embed components such as

business domains, process knowledge, technical and non-technical aspects. The key competencies of such advanced information systems courses include; understand, model and analyse the business domain and enterprise business processes; understand and analyse user needs and issues across functional units; and understand, design, develop and implement solutions that satisfy the enterprise needs. In these courses, the major component that supports a student’s learning process is the project-based learning (PBL) experience. The design and the implementation of the project experience, therefore plays a vital role in ensuring the success of the course. Working on the course project provides the students with the opportunity to apply the concepts learnt in the course and acquire the key competencies defined for the course [1].

One approach to embed the enterprise experience is through large-scale integrated projects which are popular in software engineering courses [11]. Current approaches to integrated project mainly focus on few cross-functional business units or one or two business processes or one or two business entities in the organization. Our goal is to create a truly large-scale integrated project to ensure that students experience the complexity at the enterprise level. We propose an enterprise integrated project environment (EIPE) based on business domains and business processes.

EIPE uses the approach of “project integration” which is widely used in software engineering projects where the project is divided into smaller parts among the teams and then integrated in the end to give an “enterprise view”. In this paper, we present the EIPE framework, along with the design, and implementation strategies. We adopt the ideas from previous project frameworks and adapt them to suit the course project for an IS advanced level course. We present a case study where we applied the EIPE in an advanced IS course namely, “Data Warehouse and Business Analytics”. The analysis of the student feedback for this course demonstrates the benefits of an EIPE in enhancing student learning experience. We will share the project details and challenges and discuss our findings and lessons learnt in designing and implementing an EIPE. Thus providing one pathway for

Information Systems professors to, design an enterprise integrated project environment in their courses.

The paper will be structured as follows. Section II will be devoted to literature review. Section III will provide the background of the IS advance course projects and project frameworks. Section IV describes the EIPE framework and its implementation approach. Section V describes a case study of the application of this framework. We describe our case study findings in section VI and we conclude in section VII.

## II. LITERATURE REVIEW

In this section, we briefly review related research in two different areas namely, that will address the design considerations when designing projects within a course and skills that prepare IS students for the industry needs

### A. Course Project Design Consideration

There are a number of considerations when designing the project for a technical IS course. According to Shaw, technical course projects should be interesting, gripping to sustain and motivate the students, and situated in a familiar domain so that the students can have fair time on requirement analysis [10]. David and Jennifer suggest that the course project should be designed in such a way that it provides a useful experience for the students by means of exposing them to the real world development efforts [11]. They applied a large project model where the students work on a complex project and are exposed to key software development activities. However, the focus of this study does not include domain specific knowledge and business processes which are necessary for an enterprise IS project. Additionally, students take the responsibility for coming up with a high level project design, and project management and instructor role are very minimal. Dascalu et al. show that a strategically designed project which includes phases, activities, scheduling and artefacts will enable better learning and high quality project development within the short timeframe of an academic semester [1]. In our framework, we consider these project design considerations along with the enterprise levels exposure to the students.

In project based learning courses, the instructors' role is key for the success of the course. The goals and the beliefs of the instructor will help the student teams frame the strategies they implement for the project facilitation. Cindy, describes an approach where the instructor provides heavy support and scaffolding during the early phases of the project which then fades progressively as the student teams become more responsible for their own learning and begin questioning themselves which leads to a better learning process. In our framework, we adopt a similar approach in defining the role of an instructor as a "facilitator" [12]. Additionally, the facilitator plays a vital role in ensuring the integration of the outcomes across the different teams to satisfy the goals of an enterprise project.

### B. Industry needs and IS students preparation

According to the World Economic Forum report, the gap between the skills people learn and the skills people need is becoming more visible [13]. Traditional learning models are insufficient to equip students with the knowledge they need to thrive in the industries. Another report from World Economic Forum studied employment, skills and workforce strategy for the future. The report shows that one of the top skills need for the students is complex problem solving. The report also predicts that this is going to be the top skill needed for year 2020 [14].

In the case of software professionals from Computer Science (CS) or Information Systems (IS) background, several researchers have studied the skills needed by students when they go to work in the industries. Gallagher et al. reported that both technical and non-technical skills are important for the students [15]. However, the most critical ones are non-technical skills such as project management, business domain knowledge and relationship skills. Lee et al. studied IS professionals' competencies as they progress in their career [16]. They found that the competencies change as the students gain experience in the workplace and IS professionals are required to have, higher levels of technical skills in early stages of career. In the later stages of their careers higher levels of non-technical skills are critical. The benefits of the integrated research are described in a flexible course design framework [17, 18]. In particular, the frameworks s proposed to prepare graduates ready for international projects.

When working on enterprise projects, the students should gain skills that are aligned with the above findings. The students should have complex problem solving skills, soft skills, as well as business domain knowledge. Our framework considers all these skills when designing an enterprise course project.

## III. BACKGROUND

In this section, we will first present some background of the advance courses in IS program. We will compare the project characteristics of advance courses with the foundation courses thus arguing the need for a framework to support the design of advance course projects. We then survey some existing project design frameworks and discuss the benefits and limitations of these frameworks.

### A. IS Advance Courses and Project Characteristics

Advance courses in Information Systems (IS) program aims to equip students with advanced knowledge necessary for design, development, maintenance, and management of information systems. Such training includes exposure to the complex enterprise needs and latest technologies used in the development of information systems. The courses majorly focus on understanding the business processes, cross functional units, enterprise data, technology and management aspects and project management. Table I shows sample

advance topics and some example courses in Information Systems program in our school.

TABLE I. POPULAR ADVANCE TOPICS IN INFORMATION SYSTEMS PROGRAM AND SAMPLE COURSES

Advance Topics in IS Program	Example Advanced Courses in IS Programs
Enterprise models, business processes and users, Project management	Business Process Modelling & Analysis, Enterprise Processes, Business Process Management, Enterprise Project Management
Enterprise Business and technology integration, Enterprise Security	Enterprise Integration, Advance Security in IS
Decision making process in an enterprise	Data analytics, Data warehousing, Big Data Analytics,
Enterprise integration of content, data, processes, workflows	Enterprise Web Solutions, Enterprise Business Solutions, Enterprise Information Management
Enterprise computing; cloud & distributed computing	Distributed Computing, Cloud Computing
Enterprises Social and Digital technologies	Digital Business Management, Digitalization and Transformation

The common goal of these courses is to give students an exposure to the complexity of an enterprise. Therefore, the course designers develop the content, in particular, the enterprise project that reflects the complexity of the enterprise needs. The enterprise project characteristics used in these advanced IS courses vary from the traditional projects used in the foundation courses. Firstly, an enterprise project reflects the enterprise needs, for example the cross-departmental or end-to-end business process requirements. In contrast, the projects in foundation IS courses mainly focus on the requirements of one specific department. Secondly, an enterprise project deals with large scale data or enterprise data. In projects in foundation courses, the focus is on the data within one department, for example, marketing. Thirdly, an enterprise project deals with multiple interconnected systems and technologies in the various departments in an enterprise. Sometimes, it can also extend across systems in different geographical regions. Foundation course projects deals with one or few systems with in a single department.

A big challenge in implementing the required characteristics of enterprise project within a single advance course is the time constraint. Allocating a large scale project to each team will be too demanding and will not be a feasible solution in a semester long course. This can actually impact the quality of student learning process.

In order to provide an effective enterprise project experience to students in advance courses, we propose the EIPE framework which is aligned with the enterprise project characteristics. Yet, this framework enables instructors to execute the course project in a limited time frame within one semester, which is usually fifteen weeks.

## B. Project Design Frameworks

In this subsection, we present a survey of some popular course project design frameworks. We focus on frameworks proposed in Computer Science and Information Systems programs. Several frameworks have been proposed by education researchers and IS academicians over several years. Table II shows some popular frameworks, the key attributes of the frameworks, example publications and potential limitations of the frameworks when applied for enterprise projects.

TABLE II. COURSE PROJECT DESIGN FRAMEWORKS AND ANALYSIS

Framework	Attributes	Examples	Limitations
Capstone Project Course Framework	Real projects, client or industry involvements, complex assessment rubrics,	[1, 2, 3, 4]	Not suitable for short duration one semester in course project
Multiple course Project Frameworks	Multiple courses, multi-semester or year long, real projects	[4, 5]	1. Coordination among instructors across multiple semesters 2. Expensive student commitments and team dynamics 3. Obtaining projects on a sustainable basis
Course Projects Framework	Multi-disciplinary learning, Individual projects, Team projects	[6]	Standalone nature of the projects which are undertaken during 4-6 weeks of vacation and on premise which are not suited for projects within a semester long course
PBL Framework for projects	Soft skills, technical skills, controlled university environment, small scale focussed projects	[7, 8, 9]	Small scale projects

Due to the limitations of various project frameworks shown in Table II we can deduce that these frameworks are not suitable for enterprise projects within a semester long course. In this paper, we propose EIPE framework which is designed to tackle these limitations and adapts to the characteristics of advance course enterprise projects.



Fig. 1. Enterprise architecture for Telecom industry. The verticals show core business processes. Horizontals show sub-processes. The detailed maps depict functional units as well which are not shown here.

#### IV. EIPE FRAMEWORK

We will first present EIPE framework overview followed by the implementation approach.

##### A. EIPE Overview

The goal of EIPE is to experience an enterprise project in IS program advance courses through integrated large scale course project. Fig 1 shows the overview of the EIPE framework.

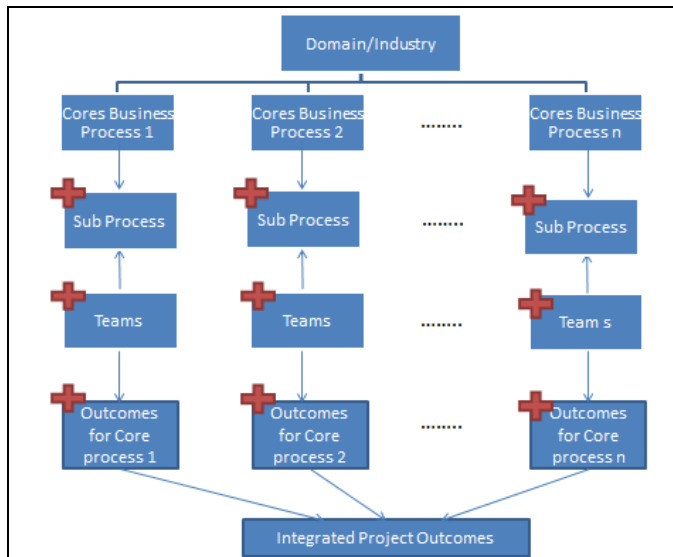


Fig. 1. Overview of EIPE Framework for IS courses

The four major components of EIPE framework are domain, core business process, sub-process and business requirements, student teams and tasks, and integrated projects outcomes. We now describe each component in detail.

**1. Domain:** One of the key aspects of enterprise projects is to expose the students to the complexity of enterprise needs. This is achievable through an experience of large scale industry domains. A domain refers to large scale industries with complex business processes. Enterprise process architecture can aid the students to appreciate the complexity of enterprise business. Fig 2 shows example

process architecture for the Telecom industry<sup>1</sup>. There are several industry maps available in market and the one we use in our example is from the enterprise software vendor SAP. The first stage in EIPE framework is the selection of the industry by the course project designer.

**2. Core business processes:** A core business is the primary area that the company focuses on<sup>2</sup> or in other words essential activity of the company. For example a university's core business is education and research. Example core business for Telecom industry is telecommunication and networking. A business process is a set of linked tasks accomplished to provide a service or product to the customer. From Fig 3, we observe that the Telecom industry has four core business processes namely, Service Platforms, Customer Experience Management, Operational Efficiencies and Market Insight, and Service Innovation. Apart from core business processes, the organization needs supporting business processes that support the operations of core business. For example, Human Resource Process is a support process for Telecom industry. In the second stage, the project designer studies the enterprise process architecture for the chosen domain and then selects specific core business processes to focus on that enables students gain a broad exposure of an enterprise project.

**3. Sub-process and business requirements:** A sub-process is a part of core or supporting business process. From Fig 3, we observe that there three sub-processes for the core process, "Service Platforms" namely, Network asset life cycle, Machine-to-machine, and Mobile commerce. In this stage the project designer can chose one or more sub-processes depending on number of student teams so that the students can have deep exposure of the enterprise process when they implement the project. Note that only the individual teams will dive into depth of the assigned sub-process/es. However, during the integration stage of

<sup>1</sup><https://www.slideshare.net/SAPTechnology/telecommunications-so-hieosp2publfinal-25761600>

<sup>2</sup> <http://www.businessdictionary.com/definition/core-business.html>

the project, the teams will get exposure to each other's sub-processes through collaborative learning.

4. **Student teams and tasks:** Teams and tasks allocation is the key component of the EIPe network. Team allocation can be straight forward for the undergraduate courses. However, the task allocation is a challenging task. Firstly, the complexity of sub-processes varies in terms of business needs, business users and number of functional units involved in the process. This characteristic of a sub-process can affect the fairness when defining the project scopes. For example, some teams will have a relatively simpler sub-process compared to other teams. Secondly, sub-processes will overlap with each other at the lower levels. This characteristic might confuse the students during integration stage. To tackle the first challenge, the instructor should do an iterative approach of requirement analysis with each team. The project scoping should be performed after each team has presented their project proposals. To tackle the second challenge, the integrated project outcome enables the students to view the bigger picture and analyse the overlaps across the teams.

5. **Integrated project outcomes:** One main goal of EIPe is to enable students gain experience of working on a large scale enterprise course project. As mentioned earlier, not all the student teams will be able to deep dive into various sub-processes. However, the main goal is to give them a broad exposure of enterprise project while they experience the depth during the implementation of project. With integration, they can see the bigger picture of the enterprise and at the same time, they can analyse where their processes fit in the bigger picture. Moreover, for better learning experience, we need a collaborative project sharing environment for the students to view the full project outcomes (integrated outcomes across each individual team). To enable this, the social media tools like Google docs, Dropbox or Wiki can be employed by the project designer. In our preliminary analysis, we observed that Wiki is an effective tool for integrated view of project outcomes due to the user-friendliness in organising the project outcomes.

In next subsection we describe the implementation details to embed EIPe in an enterprise course project.

#### B. Implementation Approach

In this section we provide the implementation details of EIPe in an advance IS course project design. Fig 3 shows the flow of implementation of EIPe.

The sequence of steps to be followed can be summarized as follows. To implement EIPe, the first step of the course designer is to define the project learning outcomes. The second step is to choose a domain and generate the high level enterprise process architecture as describe previously in Fig 2.

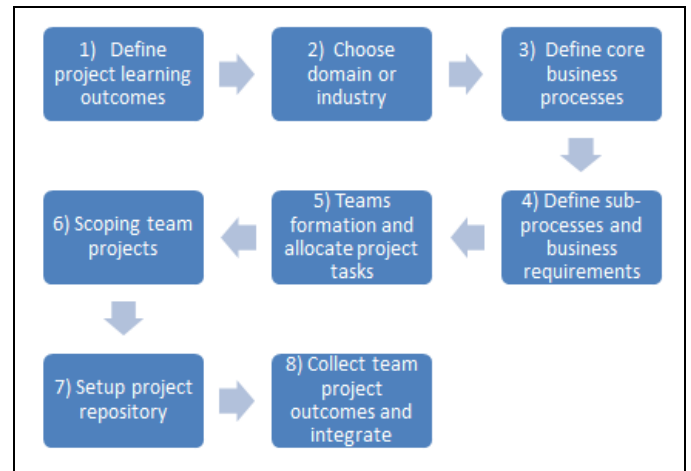


Fig. 3. EIPe Implementation Approach in IS course

The third step is to study the core business processes of the domain and choose two to three core business processes after which, the course designer choose sub-business processes for each core process. This enables the students to have a broad knowledge of an enterprise through a large scale project spread across multiple functional units and business processes in the chosen domain. The fourth step is to divide the project among student teams and define the project requirements are for each team. The fifth step is to integrate projects deliverables of individual teams using an effective social media repository such as Wiki. This step enables students to experience a holistic enterprise view of the project through collaborative learning.

Some of the questions that need to be addressed during the implementation phase are highlighted below.

#### Domain selection:

1. Which domain is the faculty familiar with in order to effectively mentor?
2. Which domain has online resources needed for the project?

#### Business requirements and scoping:

1. Which sub-processes are key processes for the chosen enterprise?
2. Which sub-processes are well connected to the other core processes?
3. Which sub-processes spread across many functional units in an enterprise?
4. What should be the scope for each team project to enable fairness?

#### Team formation and task assignment:

1. How large will each team be?
2. What tasks will be assigned to each team?

#### Integration of project outcomes:

1. Which repository is supported by the school for student projects?
2. Which social tool enables better integration and overview of the enterprise project for student learning?

## V. CASE STUDY

To evaluate the effectiveness of the framework proposed in Section IV, we applied this framework in an IS advance course, Data Warehousing and Business Analytics (DWBA). The course falls under enterprise course as data warehouses are enterprise level data and technologies, and support various business processes across multiple functional units. We first describe the course details followed by the implementation details of EIPE in the course project.

### A. DWBA Course Background

#### 1) Course objectives

Analytics has emerged as a powerful tool to track, analyse, report, and predict business data. The backbone of any analytics application is data. Before one can analyse the data, a number of tasks such as data acquisition, cleaning, loading, formatting have to be performed. A data warehouse enables to achieve these goals through various techniques and tools. Data Warehousing and Business Analytics (DWBA) course focusses on two major concepts; data warehousing and data analytics.

#### 2) Assessments

Table III depicts the assessment criteria for the course. The team project takes the highest grading component, 45%.

TABLE III. ASSESSMENT CRITERIA FOR THE COURSE

Assessment	Tasks	Scoring
Class Participation	1. In class activities 2. Discussions	10%
Quiz	3 quizzes for 45 minutes	35%
Lab assessments	5 lab online assessments	10%
Project	1. Project Proposal Report 2. Midterm Proposal Presentations 3. Final report and presentations 4. Poster 5. Wiki project site	45%

#### 3) Learning outcomes of the project

Two main learning objectives of the course project are:

1. Gain hands-on experience with key components of an integrated data warehousing and business analytics system, using a leading industry commercial application package.
2. Design, develop and demonstrate an enterprise business intelligence and analytics applications for solving a real world problem.

### B. Airlines Domain Background

In this course project, we choose airlines domain for two reasons. Firstly, the faculty and the students are familiar with the domain and there are several resources online to help students gain more knowledge about this domain. Secondly, the data sources are available for the students to work on the course project for both data warehousing and analytics components. Fig 4 shows the overview of the enterprise

architecture and Fig 5 shows the core processes and sub-processes chosen for this project.



Fig. 4. Airlines(transportation) Enterprise Process Architecture by SAP<sup>3</sup>

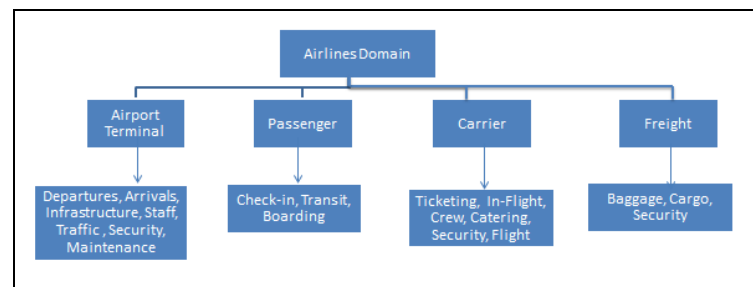


Fig. 5. Airlines (transportation) domain enterprise architecture adapted from SAP industry value maps. We focussed on core processes focussed by the course project.

### C. EIPE for DWBA

Fig 6 shows the overview of EIPE framework applied in DWBA course. We observe that, from airlines domain, the faculty used combinations of sub-processes and relevant datasets to generate the large scale project requirements.

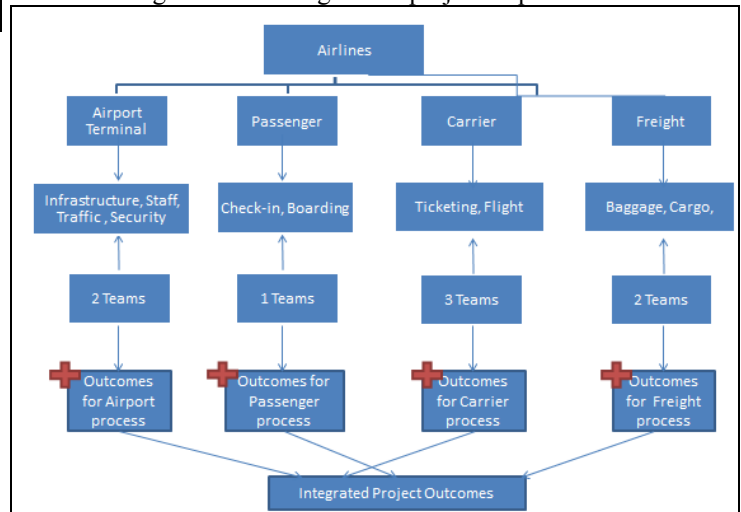


Fig. 6. Application of EIPE in Data Warehousing and Analytics Course

<sup>3</sup> <https://archive.sap.com/documents/docs/DOC-51084>



The details of the datasets are described in the next subsection. Eight teams were randomly allocated to the different sub-processes and the teams were instructed to perform preliminary analysis of the datasets suitable for their respective sub-processes.

#### D. Datasets for project

A data warehouse enterprise project requires datasets from various business processes in the enterprise and across various functional units. The course project designer performed preliminary analysis and collected the online resources as shown the Table IV.

The datasets include data from four core business processes as shown in the Fig 6 namely, airport, passenger, carrier and freight. This data is shared with the project teams during the team allocation and sub-process/s allocation. During the project implementations, the students conducted deeper analysis and augmented the datasets to align with the sub-processes assigned to the teams.

TABLE IV. SEEDED DATASETS PROVIDED TO THE STUDENTS IN THE DWBA ENTERPRISE COURSE PROJECT

Dataset type	Link
Coupon-specific information for each domestic itinerary	<a href="http://www.transtats.bts.gov/TableInfo.asp?DB_ID=125">http://www.transtats.bts.gov/TableInfo.asp?DB_ID=125</a>
Directional market characteristics of each domestic itinerary	<a href="http://www.transtats.bts.gov/Fields.asp?Table_ID=247">http://www.transtats.bts.gov/Fields.asp?Table_ID=247</a>
Characteristics of each domestic itinerary on the Origin and Destination	<a href="http://www.transtats.bts.gov/Fields.asp?Table_ID=272">http://www.transtats.bts.gov/Fields.asp?Table_ID=272</a>
Domestic market data reported by both U.S. and foreign air carriers	<a href="http://transtats.bts.gov/Fields.asp?Table_ID=310">http://transtats.bts.gov/Fields.asp?Table_ID=310</a>
On-time arrival data for non-stop domestic flights by major air carriers	<a href="http://www.transtats.bts.gov/Tables.asp?DB_ID=120">http://www.transtats.bts.gov/Tables.asp?DB_ID=120</a>
SFO Passenger, Cargo, Aircraft Landing Datasets (Cargo)	<a href="http://www.flysfo.com/media/facts-statistics/air-traffic-statistics">Download the Cargo Dataset (zip file) http://www.flysfo.com/media/facts-statistics/air-traffic-statistics</a>
SFO Passenger, Cargo, Aircraft Landing Datasets (Passenger)	<a href="http://www.flysfo.com/media/facts-statistics/air-traffic-statistics">Download the Passenger Dataset (zip file) http://www.flysfo.com/media/facts-statistics/air-traffic-statistics</a>
SFO Passenger, Cargo, Aircraft Landing Datasets (Aircraft)	<a href="http://www.flysfo.com/media/facts-statistics/air-traffic-statistics">Download the Aircraft Landing Dataset (zip file) http://www.flysfo.com/media/facts-statistics/air-traffic-statistics</a>
US Airline on-time Performance	<a href="http://datahub.io/dataset/us-airline-on-time-performance">http://datahub.io/dataset/us-airline-on-time-performance</a>
OPENFLIGHTS	<a href="http://datahub.io/dataset/open-flights">http://datahub.io/dataset/open-flights</a>

#### E. EIPE Implementation Steps Overview

Table V depicts the detailed approach of EIPE implementation in DWBA course project. We provided a

detailed weekly based approach undertaken by the faculty. As indicated earlier, the course duration is fifteen weeks.

TABLE V. EIPE IMPLEMENTATION STEPS FOR DWBA ENTERPRISE COURSE PROJECT.

Week	Project Activities
0 -1	<u>Course project preliminary study</u> 1. Define project learning outcomes 2. Domain selection 3. Research online resources
2-3	<u>Project requirement and rubrics</u> 1. Choose sub-processes 2. Prepare high level business requirements for each sub-process 3. Teams formation and allocate sub-processes to teams 4. Setup Wiki for project repository 5. Provide data resources to the teams
4-6	<u>Project proposals</u> 1. Students prepare project proposals 2. Students do preliminary study (domain, process, data, needs) 3. Prepared detailed business requirements from analytics view 4. Students setup project sites on Wiki
7	<u>Project Scoping</u> 1. Student mid-term presentations 2. Project scoping 3. Students update Wiki with proposal details
8-12	<u>Project implementation</u> 1. Design and implementation of data warehouse 2. Design and implementations of analytics engine 3. Update Wiki for integrated view 4. Perform analytics and gap analysis
13	<u>Project presentations</u> 1. Final presentations
14-15	<u>Final submissions</u> 1. Submit final report 2. Submit poster 3. Final updates to Wiki

## VI. FINDINGS FROM CASESTUDY

In this section, we present our experiences with EIPE based enterprise project. We conducted a student survey and in this section, we present the quantitative and qualitative feedback on the course project to evaluate the EIPE framework. We will also present lessons learnt by the course designer in implementing EIPE in DWBA course.

#### A. Student Feedback

In order to gather student feedback, an online survey was conducted and 31 students participated in the survey. Table V shows the questions and survey results.

TABLE VI. STUDENT QUANTITATIVE FEEDBACK ON DWBA ENTERPRISE COURSE PROJECT

Survey Question	Agree or Strongly Agree
Project helped me understand the challenges of huge data sets in big sector	87.10%
Project provided an opportunity of implementing a data warehouse in an enterprise business case	96.77%
Project provided opportunity to investigate and learn new technical skills	93.55%
Project increased interest in the Data Warehouse and Business Analytics topics	83.87%
Project difficulty levels are manageable	80.65%
All the teams should be given the same dataset and project scenario.	32.26%

We observe that more than 96% agree that the course project enabled them to implement DW for a given enterprise scenario and less than 33% agree that all teams should be given same project. More than 80% of students felt that the project difficulty levels are manageable. We further analysed the comments from the students to gain deeper insights of their learning process. Fig 7 shows the comments from students on the course project.

“Sufficient hands on lab exercises was good. The project was very **interesting.**”

“In this course we need to do up a **wiki** and i think it is **good as it is a knowledge platform** for the next batch of student as well.”

“The course is very challenging and allows us to solve specific business problem easily. However, the learning curve for this course might be a bit too steep which in turn causing us to **spend more than the time** we have planned.”

“The course project gives us a **hands-on experience** on building an enterprise data warehouse”

Fig. 7. Sample students' comments on DWBA enterprise project

In general many students find that the project is very interesting and they enjoyed the presentations from all the teams. We observe that the students like the project aspects such as hands-on experience, business domain knowledge and using the social platform Wiki and appreciate the collaborative learning of an enterprise project. Figure 8 shows some sample student Wiki project sites. Some students also find that the time is limited due to the steep learning curve. This is due to the fact that the course project requires several technologies; data warehouse tool, data mining tool and analytics dashboard tools.

### B. Lessons Learnt

Managing the large volume of data and attributes were the key hurdles in facilitating the project. Other challenges during the early phases of the project included technical support and project scoping. Some teams proposed multiple outcomes

while some proposed very few outcomes. The faculty had to spend a considerable amount of time to ensure fairness when deciding project scopes across all the teams. To ensure the learning outcomes of enterprise project, the faculty also conducted class discussions on the project.

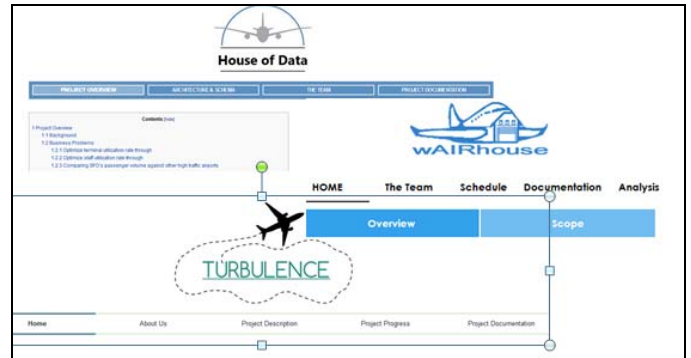


Fig. 8. Sample students' project sites from Wiki

Faculty observed that the teams gained deeper knowledge of the business process that they focussed for their own project. At the same time, they have experienced a large scale enterprise project in several ways. Firstly, the overlaps of the sub-processes with other teams provided an opportunity to learn the concept of cross-functional units in enterprise business process. Secondly, Wiki enabled the students to view other teams' projects outcomes and enable them to see the holistic view of the enterprise project. Thirdly, the students' midterm and final presentations enabled the students to understand the integrated project outcomes and gain a good overview of the project domain. The faculty summarised the presentations of each individual team and highlighted the overlaps to ensure that the students gained an integrated enterprise view of the project.

## VII. CONCLUSION

Course designers of projects in advance Information Systems courses should consider the need to expose the students to the complexity of a real enterprise by designing a large scale enterprise project. However it is imperative to address the time constraint and other technical challenges should so that the student experiences a high quality learning process. We proposed an EIPE framework for designing enterprise projects and its implementation approach. Furthermore, in this paper, we presented a case study where the framework is applied to the data warehousing and business analytics course, which focusses on enterprise data and analytics requirements.

Our findings show that the students liked the project and they experience a holistic view of an enterprise. We provided a pathway for Information Systems (IS) professors to design projects to include an enterprise context.

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