# IS 5960-03: Master’s Research Project – Experiential Report

## Prepared by:

## Anusha Boppa

## Sunil Kumar Bandili

## TharunTeja Bavandlapelli

## Venkateswarlu Jampani

## Sairamlaxman Reddy Burugapalli

## Team 2

### Career Recommendation System

### School of Professional Studies, Saint Louis University IS-5960-03 Master’s Research Project Prof. Maria Weber May 06, 2025

## **Description of the intended user of the application**

The intended user of the Career Recommendation System is a Career Services Analyst or Career Counselor, typically working within the Career Services Department of an educational institution or a mid-to-large-scale organization. This individual operates at a mid-level in the organizational hierarchy and reports to a Director of Career Services or Talent Development Manager. Their core responsibilities involve supporting job seekers such as students, alums, or employees by offering insights into job market trends, identifying skill gaps, and recommending suitable roles based on the user's background and interests.

In defining this user profile, we asked a simple question: *Who will benefit from analyzing job-related data across multiple dimensions such as skills, salaries, and industries?* While the job seeker is the ultimate beneficiary, we recognized that those who regularly guide and advise others, such as career advisors or academic placement officers, are often the most frequent users of this data. These users need comparative, filtered, and role-specific insights to help individuals navigate career options. As a result, we tailored the dashboard not just for personal use but to help these professionals make efficient and informed recommendations across many different user profiles.

Within an organizational hierarchy, the Career Services Analyst plays a decision-support role, equipping leadership with strategic reports on job demand, placement success, and industry alignment while working directly with job seekers in advising sessions and workshops. These advisors often act as translators of job market data, interpreting charts and trends into personalized career planning insights for users.

One challenge we faced was moving beyond the apparent "job seeker" persona and designing for the advisor persona instead. Building solely for individuals would have limited the dashboard's broader utility. By focusing on the needs of professionals who support many users, we designed a system capable of handling personalized queries and institutional-level analytics. This required incorporating interactive filters such as skill, role, company, and experience level, all tied to visuals that can quickly adjust to specific decision contexts.

Another design challenge was ensuring that the system remained helpful at both a micro (individual) and macro (organizational) level. Some users want detailed, user-specific data, while others seek broader summaries and insights. We resolved this by combining summary KPIs, slicers, and responsive charts that could adapt to both scopes of analysis.

Several courses from our curriculum helped us tackle these challenges effectively. The Information Systems course helped us understand the structure and flow of data within a system and how to model user interactions. Data Visualization taught us to select appropriate charts, use intuitive layouts, and reduce cognitive overload. Applied Analytics guided our thinking on extracting meaningful insights from raw datasets, helping us frame decision-making logic around the data. Information Retrieval helped us implement filtering logic and design flexible querying structures for user-level exploration. While Mobile Web Development was not directly applied, its emphasis on user interface responsiveness and adaptability indirectly influenced our design mindset, especially regarding layout and accessibility.

In conclusion, the Career Recommendation System is designed for individuals exploring their own careers and for professionals responsible for guiding others through career planning. Recognizing this dual-use case, we developed a flexible, insightful system that can be effectively deployed in educational, institutional, or consultancy environments to support smarter, data-driven career decisions.

## **Decision-making needs of the user**

The intended user of our application, a Career Services Analyst or Career Counselor, plays a crucial role in shaping the career development strategies of students, graduates, or employees. This user is primarily responsible for three key areas of business: (1) personalized career advising, (2) workforce readiness analysis, and (3) institutional placement reporting.

As a career advisor, the user must regularly assess which job roles are trending, what skills are most in demand, and how salary expectations vary across job titles and experience levels. Our dashboard helps fulfill these responsibilities by offering a comprehensive view of job market trends dynamically filtered by experience level, location, work type, and skill requirements. For example, the system's ability to show "top skills by industry" or "salary by title" enables the advisor to give highly targeted guidance to users with diverse backgrounds. Similarly, the system supports workforce readiness analysis by identifying skill gaps and the difference between user-entered competencies and those required by in-demand job roles. Lastly, by providing visual summaries of job counts by industry, remote work trends, and company-level hiring patterns, the user can generate aggregate reports to support decision-making at the departmental or institutional level.

We arrived at these decision needs by mapping out the day-to-day responsibilities of career advisors and placement coordinators, especially in academic and training institutions. We also reviewed job descriptions and responsibilities from real-world Career Services departments to understand the kinds of metrics and insights these professionals rely on. This research made it clear that they do not just guide individual job seekers. They are often responsible for data-driven planning, employer outreach, and program performance tracking.

One major challenge we faced was balancing the needs of both individual and institutional users within one application. On one hand, the system had to allow granular, personalized insights for a single job seeker. On the other, it needed to provide broader trend visualizations for strategic analysis. We leveraged Power BI's dynamic filtering features to solve this and used calculated columns and slicers to enable multi-level analysis. Another challenge was identifying which metrics would be most actionable for advisors without overwhelming them with excessive data. This required careful iteration and prioritization of insights that offered straightforward, strategic value.

Several academic courses played a key role in helping us address these challenges. Information Systems helped us understand how to organize, structure, and model our data effectively across multiple related tables. Data Visualization was essential in selecting chart types, color palettes, and layouts that made information clear, engaging, and actionable. Applied Analytics guided us in determining which data points and KPIs were most relevant to decision-makers, helping us extract meaningful insights rather than just presenting raw data. Information Retrieval informed our use of filters and search-like logic within the dashboard, helping users access specific data segments easily. Although Mobile Web Development was not directly used in Power BI, the design mindset it encouraged, especially around user experience and responsiveness, subtly influenced how we structured and arranged dashboard components for clarity and ease of navigation.

In conclusion, our users' decision-making needs span individual-level advising and institutional workforce planning. By identifying and prioritizing these needs early in the project, we were able to build a system that is both flexible and impactful. The knowledge gained from our curriculum allowed us to combine technical proficiency with real-world applicability, resulting in a decision-support application that effectively addresses the challenges faced by career development professionals

## **Data validation and preparation**

Our application draws upon several key tables that simulate an EHR-like (Employment & Hiring Records) database structure, representing a realistic labor market dataset. These include: postings.csv, job\_skills.csv, salaries.csv, companies.csv, job\_industries.csv, benefits.csv, and employee\_counts.csv. Each contains specific fields that serve as direct inputs into the dashboard or are used to derive new, computed fields. For example, the postings table provides fields like job\_id, title, location, formatted\_work\_type, formatted\_experience\_level, and remote\_allowed, which are essential for filtering, segmentation, and visualizations. Similarly, job\_skills contains skill\_abr, which we used to compute skill frequency metrics. The salaries table includes med\_salary, min\_salary, and max\_salary, which were used to derive average compensation figures and trends across roles and experience levels.

We identified these tables by mapping the functional requirements in our project charter to specific data needs. For instance, when planning the “Top Skills by Industry” chart, we traced it back to the job\_skills and job\_industries tables. Similarly, KPIs like “Average Salary” were tied to med\_salary and title in the salaries table. Entity-relationship modeling, first developed during our early design phase, helped confirm which tables could be joined via shared keys (e.g., job\_id, company\_id).

We performed consistency checks for validation using Power BI's Data view and SQL-like filtering in Power Query. We checked for:

Orphan records (e.g., job\_id in one table not existing in others),

Inconsistent data types (e.g., remote\_allowed as string vs boolean),

Nulls in critical fields (e.g., missing company names),

Outliers in salary ranges (e.g., jobs with salary above $1 million or below minimum wage),

Duplicates based on composite keys (job\_id + title + company\_id).

We cross-verified computed aggregates (like total jobs by the company) with manual row counts or pivot summaries where possible. Additionally, timestamp fields such as listed\_time and time\_recorded were converted from Unix epoch time to readable date formats for visualization, and their trends were validated against known simulation ranges.

We performed several necessary data transformations and computations:

Created a Remote Option field using a calculated column to convert remote\_allowed = 1 to "Remote" and blanks to "On-site."

Derived Recorded Date from time\_recorded in employee\_counts by converting Unix time to datetime, allowing trend analysis over time.

Built a Company Size Category by bucketing company sizes into labels like "Small," "Medium," and "Large" for cleaner visualizations.

Aggregated job\_id counts by skill, company, and industry to serve as input for visual summaries.

Removed or replaced placeholder values (e.g., “This position requires…” in skills descriptions) to ensure data quality in word clouds and bar charts.

These operations were critical to producing clean, readable dashboards with accurate KPIs. The rationale was analytical (ensuring aggregation logic held up) and visual (ensuring outputs made sense to end users).

Several courses significantly supported our success in this stage. Information Retrieval taught us to design data models with proper primary and foreign key relationships, which made joins and filtering accurate. The Data Visualization course helped us realize how messy or inconsistent inputs could lead to misleading visuals, driving our motivation to transform the data properly before visualizing it.

One of the biggest challenges was dealing with fields that were present but inconsistently populated, such as remote\_allowed (often blank), or skills that were text-heavy and not tokenized. We overcame this by creating new columns, using SWITCH() and IF() DAX functions, and pre-processing columns in Power Query. Another challenge was integrating all datasets without creating circular dependencies or relationship ambiguity, especially when multiple tables shared job\_id as a foreign key. This required careful data modeling in Power BI's Model View.

In conclusion, rigorous data validation and thoughtful transformation were key to building a system that job seekers and advisors could trust. By aligning our approach with techniques learned in multiple courses, we ensured our data was clean and fit for purpose, enabling meaningful insights and confident decision-making.

### **Design of user interface**

Our application features a multi-tabbed user interface designed in Power BI. Each dashboard supports different types of decision-making tasks for the end user, primarily a Career Services Analyst or Career Counselor. These dashboards were built to deliver clear, accessible, and interactive visual insights that could guide both individual and organizational career planning decisions.

The first dashboard, Job Explorer, provides a high-level view of the job market. It includes KPI cards showing the average salary and total job listings, helping users quickly understand the market scale. A bar chart highlights the most in-demand skills, while a line chart shows job concentration by location. A pie chart compares remote versus on-site job availability, and a salary-by-title chart provides compensation benchmarks. This page is fully filterable by job title, experience level, location, and work type, enabling personalized insights based on the user’s or client’s background.

The second dashboard, Company & Industry Explorer, supports broader, strategic views. It includes visuals such as top hiring companies, job postings by industry, and average salary by experience level. A bubble chart plots job openings against company size, revealing where growth is concentrated. A company-specific skills and employee growth line chart further enrich the analysis, helping advisors or job seekers understand hiring patterns and required competencies.

The third dashboard, Application & Work Type Insights, addresses how users interact with job listings. Charts in this tab categorize jobs by application type and work type (full-time, internship, contract). A time-based line chart tracks application trends by company and remote status. Filters allow users to narrow insights by domain, location, and company. This tab supports analysis of candidate behavior and market responsiveness.

We selected each visual component based on our project requirements and the real-world questions users would need answered. These include "Which companies hire the most?", "What skills should I learn?" and "Where are the highest-paying jobs located?". To ensure that our visual elements satisfied these needs, we mapped each chart to a project requirement in a traceability matrix and simulated realistic user scenarios to verify that the visuals provided meaningful insights.

Designing the interface presented a few challenges. First, we had to balance simplicity with functionality, ensuring the dashboard was usable by non-technical users while still powerful enough for deeper analysis. We addressed this by choosing clean, intuitive layouts and grouping related visuals logically. Another challenge was integrating multiple datasets (postings, skills, salaries, companies) without creating visual or relationship errors. We resolved this through careful data modeling and calculated fields.

Several courses in our curriculum helped us succeed here. The Data Visualization course was critical in guiding our choices around chart types, color schemes, layout, and clarity, ensuring our visuals told a story instead of just showing numbers. Information Systems helped us understand how to structure data for usability and integrity and to think about the broader context in which our tool would be used. Applied Analytics contributed to our understanding of how to derive actionable insights from raw data, which included trend identification, user behavior analysis, and segmentation. Additionally, Information Retrieval helped us conceptualize how filters, search logic, and query-based data views could be structured to improve accessibility and interactivity across all dashboards.

In summary, our user interface was designed with the end user's goals: to make sense of complex job market data in a clear, actionable, and flexible way. We delivered an interface that supports confident, data-informed decision-making by applying techniques learned through coursework and solving challenges through iteration and testing. Top of FormBottom of Form

### **Reflection**

Completing this project has given us deep insights into the real-world process of building a decision-support application from the ground up. From initial problem definition to final dashboard deployment, every stage required critical thinking, cross-functional collaboration, and adaptability.

The project began with defining and refining our project charter and problem description. Initially, we had a broad goal of helping users make better career decisions. However, through structured brainstorming and feedback sessions, we narrowed our focus to three core goals: identifying in-demand skills, visualizing salary trends, and enabling job seekers or advisors to filter opportunities based on meaningful criteria. We learned that a clear and detailed project charter is not just a formality. It acts as a blueprint that guides every decision, from data modeling to visual design. As we progressed, we revisited the charter multiple times, refining it to align with evolving insights and user needs.

Teamwork was a critical factor in our success. Our team had four members, and we divided responsibilities based on each person's strengths and learning goals. One team member led data preparation and cleaning, ensuring data quality and consistency across tables. Another focused on dashboard design and visual aesthetics, applying principles learned in the Data Visualization course. A third member worked on model relationships and DAX calculations, while the fourth coordinated documentation, presentation materials, and project tracking. We held weekly meetings to check progress and used tools like Trello and Google Docs for coordination. These roles were not rigid, and we often stepped in to support each other during tight deadlines or when someone got stuck, fostering a strong sense of collaboration.

To build this application, we acquired knowledge in a new domain: job market analytics. We had limited prior exposure to this field, so we began by researching job platforms like LinkedIn and Glassdoor to understand how career trends are typically presented. We also studied the structure of simulated job datasets provided to us and mapped them to real-world equivalents. Our approach was exploratory and iterative. We tried various chart types and filters in Power BI, tested them with sample queries, and refined them based on what made sense visually and contextually. Tools like Power Query, DAX, and Power BI's Data Model view were essential. What worked well was building small prototypes early and validating them with actual use cases. What didn't work initially was trying to build too many visuals, which overwhelmed the dashboard and made performance suffer. We realized through trial and error that simplicity and user focus are more impactful than volume.

Individually, we learned a lot about self-efficacy. Each of us approached new concepts differently. Some preferred structured learning through documentation or video tutorials, while others learned best by trying and failing within the tool. We also became more conscious of how to communicate and negotiate responsibilities. Initially, there was hesitation in delegating ownership, but as we became more comfortable, we trusted each other's abilities and created a system where accountability was clear but not rigid. Another key takeaway was our collective ability to estimate effort. Early in the project, we underestimated the time required for data cleaning and overestimated how quickly visuals could be built. We improved our estimates and delivered on time through better task tracking and check-ins.

The lessons we've learned from this project will significantly influence our academic and professional journeys. We now understand the importance of starting with a well-defined problem, using accurate data to drive decision-making, and designing with the user's needs at the center. In future roles, whether in analytics, software development, or consulting, we'll apply these principles to build tools and solutions that are technically sound but also relevant and actionable. Academically, this experience has deepened our appreciation for interdisciplinary projects that blend technology, data, design, and human behavior. We leave this project with more than a working application. We use the mindset and toolkit to tackle complex, real-world problems collaboratively and creatively.