Specification, Design and development of a Conversation GenAI powered Dashboard with a recommendation engine for Identification of the Traits of a Good Instructor and for suggesting improvement approaches based on the traits of the top performers

Background

* Instructors within an educational system, comprises a combination of various educational groups, faculty members, researchers, students, as well as administrative staff.
* Each group of faculty members contributes to different fields.
* The management of all data records related to the performance and activities of the faculty and its members leads to better monitoring, identification of weaknesses, strengths and the traits of a “good” instructor from the top performers allowing the educational institution to characterize instructors which can be used to improve the overall performance of the faculty.
* A conversationally enabled analytical dashboard is the primary interaction tool that is used for monitoring and metricizing faculty performance and using it to identify the traits of good instructors.

# Objectives of the Effort

The objective of this effort is to develop a functional, conversationally driven dashboard for the faculty of BITS and metricize and identify the traits of a good instructor and use that to suggest improvements in its teaching staff’s efficacy.

Effort Approach and Phases

This effort uses a mixed methods approach that will be conducted in four main phases.

* In the first phase, all the resources related to the functional dashboard are reviewed in order to identify its functional and operational requirements.
* In the second phase, the detailed feature statements and capabilities of the software are determined by both qualitative (interview) and quantitative (Delphi) methods.
  + In this phase, eight people will be interviewed during the qualitative phase, and thematic analysis will be used to analyse the data.
  + For the quantitative step, the two- round Delphi technique will be conducted by the purposeful selection of 21 individuals.
* In the third phase,
  + Deployment of the Spanda AI Software Platform will be first performed
  + A custom application comprising of a conversationally enabled GenAI powered dashboard along with the associated retrieval augmented language model and the recommendation engine is developed using Python programming language in an IDE
  + The application will be deployed on a private cloud to ensure data privacy
  + 15 people among faculty members and managers, who are identified as the users of the dashboard software, are selected to evaluate the software.
  + Users’ satisfaction with the dashboard software is assessed using a Dashboard Assessment Usability Model.
  + Usability Evaluation Criteria for Dashboards
    - According to the review of other questionnaires used in previous studies, the following criteria are identified for dashboard evaluation: *usefulness, operability, learnability, ease of use, suitability for tasks, improvement of situational awareness, satisfaction, user interface, content, and system capabilities*
    - Usefulness
      * Usefulness is usually defined as meeting a customer's needs or providing a competitive advantage with the product's attributes or benefits. Designers, generally, aim to deliver useful products. The “usefulness” criterion was used instead of “effectiveness and efficiency” to evaluate the usability of dashboards.
    - Operability
      * It refers to a user's ability to use and control a dashboard for performing their tasks. In the present study, operability included criteria, such as representation of data in detail, access to various filters and reports, and ability to correct errors and support user. The user control is measured under the “operability” criterion.
    - Learnability
      * Learnability is a quality of software interface that allows users to quickly become familiar with them and able to make good use of all their features and capabilities.
    - Ease of Use
      * It is a fundamental concept explaining how easily users can employ a dashboard. This criterion was used for dashboard evaluation in the EUCS, Health-ITUES, and TAM questionnaires.
    - Suitability for Tasks
      * This criterion can help to assess if users can find out whether a product or system is appropriate for their needs. It provides support for the users' daily activities and ensures the compatibility and organization of data on the screen with the user's tasks.
    - Improvement of Situational Awareness
      * Situation awareness at a fundamental level is about understanding what is going on and what might happen next. The criteria for evaluating situational awareness were divided into instability representation, complexity representation, variability representation, arousal support, concentration support, spare mental capacity support, and division of attention.
    - Satisfaction
      * This criterion refers to satisfaction with the features, capabilities, and ease of use of a dashboard.
    - User Interface
      * It consists of visual and interactive tools. Visual tools in a dashboard involve color coding for data visualization, histogram plots, pie charts, bar graphs, gauges, data labels, and geographic maps. The interactive techniques also include customizable searching, summary view, drill up and drill down, data ordering and filtering, zoom in and zoom out, and real-time feature.
    - Content
      * This criterion involves the quantity and quality of data displayed by a dashboard. The quantity of displayed data was measured using two questionnaires (SART and PSSUQ), while quality was measured using SART. The amount of displayed data and their compatibility with the users' tasks were also evaluated, and data accuracy, timeliness (being up-to-date), comprehensiveness, and relevance were used for measuring data quality.
    - System Capabilities
      * Evaluation of compatibility is a criterion to assess software in terms of compatibility with work-related requirements. The dashboard capabilities are evaluated to determine how well its compatibility to work-related processes and how well it satisfies the users' data requirements.
  + The collected data will be analysed using descriptive statistics and data analysis software to suggest feedback and improvement as well as to assess large-scale deployability

# Final Product

* The Final product of this study is a GenAI powered dashboard for monitoring, evaluating performance, characterizing a “good” instructor and providing improvement recommendations to supporting the improvement of instructors and resources at the faculty level.
* The steps of designing this dashboard can be a basis for developing better dashboards for evaluating other faculties or even other universities.

## Definitions, Description of current shortcomings and needs

* A faculty, as an educational system, consists of a combination of various educational groups, faculty members, researchers, students, and administrative staff.
* Each faculty member contributes to different areas (teaching, research, and management).
* A faculty is a place where different types of courses, learning activities, conferences and conventions are held.
* The data related to these activities with the participation of faculty members are facts and information resulting from academic activities.
* The data of a faculty refers to the information linked with the academic performance of its instructors and lecturers, such as the details of academic services and contributions, courses completed, student evaluations provided, the number of annual research publications, and the number of committees in which the faculty member is a member of etc.
* Although the collection, management, and reporting of faculty data is crucial for each faculty member, as well as for the institution itself as a complete establishment, numerous gaps exist in this area.
* While a faculty member may be involved in several activities, most of these activities are not documented and recognized because universities lack a central system for effectively recording these data and presenting a comprehensive report of such activities and performance feedback that can be used to guide faculty performance improvement.
* Currently, typically in many universities, different independent systems host faculty data. The lack of internal communication between these systems causes these data to be enclosed in a contained silo.
* Retrieving data from multiple systems is often a manual and a difficult process for administrative staff and faculty members.
* As these data are not analysed using Generative AI techniques or merged to provide an integrated picture, their trends and inter-relationships cannot be exploited
* This is a lost opportunity
  + to acquire data
  + to discover information
  + extract knowledge about instructors and their methods
  + identify the traits of good instructors from the top performers
  + using those identified traits to recommend performance improvement using AI powered recommender systems)
  + Positively impacting the overall quality of education delivered.
* Currently, the data recording aspect is inconsistent and inadequate in most higher education institutions,
* There also is only partial automation in terms of recording and sharing data between different systems and constituents.
* Therefore, faculty members and managers spend a lot of time and effort in manual data entry to gather or track the details of academic activities and drive their assessments and performance improvements.
* Despite the fact that the manual entering of data is unavoidable in some cases, use of intelligent automation, enabling interoperability between systems to prevent the duplicate recording of data and use of AI to enable dashboards is not well implemented today.
* In addition, faculty members have inadequate time and skills to perform statistical analyses on data (e.g., findings correlations, querying, recommendations etc.) and extrapolate valuable interpretations, targeted feedback, or practical complementary objectives as the dashboards are poorly design and do not provide easy to use conversational interfaces or AI powered engines.
* As a data management as well as decision support tool, conversationally enabled dashboards are one of the most effective and renowned forms of data objectification.
* A dashboard can be defined as: “a tool for visualization that provides the possibility for acquiring awareness, finding trends, planning, and real comparisons.
* These items are repeatedly embodied in a simple and functional user interface.
* A dashboard of accumulated data effectively presents multiple sources and a comprehensive summary of important information that can be assimilated by faculty members at a glance, queried, directed to identify traits of “good” instructors based on top performers.
* These dashboards enable organizations to measure, monitor, characterise and improve the performance of faculty members and drive continuous improvement using various recommendation methods more effectively.
* These dashboards build on the foundations of business intelligence, data integration infrastructure, data science and Generative AI and are used for monitoring, analysis, and management and decision support.
* Developing a faculty performance evaluation, benchmarking and improvement dashboard is useful for quickly sharing with faculty members information about their performance in a way that requires minimal effort and helps them better understand the data by querying the data using language-based interfaces (chatbots) and asking for suggestions on improvement (recommendation engines) as well as identifying those traits (Factor Analysis, Causal Analysis) that can be used to identify an effective teacher.
* Observing, querying and interpreting the data presented in large tables and lengthy reports are exhausting and time-consuming for faculty members. In other words, a dashboard, if designed appropriately with conversational interfaces, can help faculty members quickly spot their strengths and areas of progress and identify the trends and steps necessary for improvement and recommend/suggest methods for improvement.
* Based on the current state explorations, there are substantial gaps in the reporting and management of faculty data.
* Therefore, it is necessary to develop a comprehensive dashboard for monitoring and evaluating the performance of instructors across various activities such as education, research, cultural fit, student affairs participation, resource management effectiveness and technology development.

Approach Details

* The effort will be carried out by the combined method of consecutive mixed designs.
* In a sequential design, the data collection and data analysis of one component take place after the data collection and data analysis of the other component and depends on the outcomes of the other component.
* Mixed Methods Research combines both closed-ended response data (quantitative) and open-ended personal data (qualitative).
* The research environment is the Faculty of BITS. The study and software development must have obtained an ethical approval and will be conducted in four phases.

## Phase One: Identification of functional and non-functional requirements of performance dashboards and performance indicators and traits of good instructors through interviews and systematic research

* + The aim of this phase is to extract the functional parameters of the faculty, as well as the capabilities of the performance dashboard.
  + In this step, the research and interviews are performed using a combination of methods. The indicators of performance identified are divided into five different groups, including education, research, cultural and student affairs, resource management, and development & technology, each of which has its own performance indicators.

## Phase Two: Requirements Of the Instructor Traits Dashboard From The Perspective Of Users

* This phase is conducted in two steps.
* In the first step, a qualitative study is conducted to identify the requirements of the performance dashboard software.
  + For this purpose, eight educational group directors and faculty directors are selected by purposeful sampling for interviews.
  + The average duration of each interview will be 30 minutes.
  + At this stage, after coordinating with the interviewee and obtaining informed consent, the voice of the interview is recorded using an electronic recorder, and then its text is transcribed verbatim in Microsoft Word.
  + The questions of the interview are related to the functional and non-functional requirements of the dashboard, as well as the performance preferences of users.
  + After transcription, the interviews are subjected to code extraction and then thematic analysis.
    - Phase 1: Familiarizing yourself with your data
    - Phase 2: Generating initial codes
    - Phase 3: Searching for themes
    - Phase 4: Reviewing themes
    - Phase 5: Defining and naming
    - Phase 6: Producing the report themes.
* In the second step, a questionnaire is designed to identify the key performance indicators of the faculty using the two- round Delphi technique.
  + Twenty individuals are purposefully selected among academic members, educational group directors, and faculty directors.
  + In the first step of the Delphi technique, a questionnaire with three-choice questions (disagree, no opinion, and agree) and an open-ended question at the end of each section are completed, so people could state if they think anything should be added to the questionnaire for the second step of the Delphi technique.
  + In the second step of the Delphi Technique, the indicators proposed are added and subjected to a poll.
  + For data analysis, items with higher than 75% agreement are accepted, those with an agreement between 50–75% enter the second round of Delphi, and items with < 50% agreement are omitted from the questionnaire.

## Phase Three: Software Development and Deployment

* For writing the code of this software, the Spanda Platform, Python and Web Technologies are used.
* The interface of the software is designed using Html, JQuery, CSS, and Javascript languages to be run from standard browsers
* Database software is used for designing tables and managing the database.
* Private Cloud connectivity is available

## Phase Four~~:~~ Evaluation Of User Satisfaction

* In this phase, 15 of the academic members and managers of the faculty who are the users of the dashboard software are chosen.
* In order to evaluate user satisfaction with the dashboard software, a 20 question Dashboard Assessment Usability Model scored based on a five-point Likert scale (1 = "completely disagree"; 5 = "Completely agree") will be used.
* In addition, two open-ended questions are presented to the participants so that they can express their viewpoints and recommendations.
* This scale will evaluate the dimensions of satisfaction (four questions), effectiveness (two questions), efficiency (two questions), operability ( ve questions), learnability (four questions), user interface aesthetics (one question), appropriate recognizability (one question), and accessibility (one question).

## Open-ended Questions

* Is there any additional information besides the ones provided here that you would want to see in the dashboard?
* Do you have any other comments or suggestions that you would like to share with us?
* The validity and reliability of the questionnaire have been confirmed previously.
* In the final step, the data are presented in tables using descriptive statistics such as frequency and percentage. Data analysis is conducted in Jupyter Notebook software.

# Ethic~~a~~l consider~~a~~tions

* This study has been approved by the University Ethics Committee.
* The confidentiality and anonymity of participants’ information are strictly observed.
* During interviews, participants’ voices are recorded after obtaining their written informed consent.
* Participants’ information will not be disclosed in any publication form, and they will be clearly explained that they have the right to withdraw from the study at any time.

## Brief Value Discussion

* This effort aims to design, implement and evaluate the effectiveness of a GenAI powered performance dashboard for functional monitoring, evaluation, and identification of traits of a good instructor to help improve instructor performance and resource management at the faculty level.
* The steps used for developing this dashboard can provide a basis for designing better performance trait identification and recommendation engines for improvement of instructor performance based on the trairs of good instructors gleaned by analysis of top instructors.
* Regarding the importance of information integration in organizations such as universities, it is essential to trace the flow and dimensions of information.
* The lack of proper management of information resources can impede the efficient identification of the traits of good teachers from the top performers and thus hinder achieving organizational goals
* Motivating instructor improvement by working with integrated information presented via graphical dashboards and using conversation interfaces, language models and recommendation engines is possible
* Eliminating redundant work in different departments, retrieval of similar information, and finally, duplicate flowing of this information into multiple organizational databases, which requires spending extra time and costs to reuse them is possible through this work.
* The establishment and use of comprehensive information resources play a strategic role in the qualitative development of universities instructional staff and their transformation into pioneer organizations and contribute a substantial role in achieving the strategic goals of the university.
* The information obtained from the information system provides a powerful management tool in the higher education system.
* Because of providing timely and accurate information, AI powered conversation dashboards with integrated recommendation systems are considered the most powerful systems to fulfill the informational needs of organizations, including universities, and to handle bulk amounts of organizational data about insttructiors.
* Performance Improvement can be achieved based on the identification of the traits of the top faculty performers through a performance dashboard, and using a recommendation engine in combination with a performance coaching process through which the function of instructors is formally and regularly assessed at certain intervals to ensure continuous improvement.
* Evaluation of the performance of academic members refers to the regular assessment of their educational/research activities and determining to what extent the goals of the educational system, according to predetermined criteria, can be achieved.
* Functional monitoring refers to the real-time observation of the faculty’s key performance indicators.
* Faculty resource management encompasses being informed of the current situation of human resources and equipment and figuring out optimal ways of deploying them to improve overall faculty performance.
* Despite the strengths of this approach, we may face some challenges while conducting various phases of this research.
* For example, in phase one, participants may refuse full cooperation in completing the questionnaire or conducting the interview due to their busy work schedules.
* We will try to distribute a considerable number of questionnaires among users to obviate this challenge.
* During the implementation phase, the software designed may not be suitably integrated with other organizational systems, interfering with information exchange.
* This challenge will be addressed by writing data processing pipelines that normalize and integrate data from various sources.