A Comparative Study of Faculty Development Programs: A Case For the Application Of Web Scraping and Natural Language Processing

Section A-Research paper

A COMPARATIVE STUDY OF FACULTY DEVELOPMENT PROGRAMS: A CASE FOR THE APPLICATION OF WEB SCRAPING AND NATURAL LANGUAGE PROCESSING

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Abstract

Results of a comparative study of Faculty Development Programs in India and the USA are presented in this paper. Using Web scraping techniques and the Natural Language Processing tools, websites related to the Teaching and Learning Centres in both countries were scraped to compare the FDP activities. The paper also reports the results of a survey on the impact FDP activities in both countries.

Keywords: Faculty Development, Web Scraping, Natural Language Processing

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Eur. Chem. Bull. **2023**,*12(Special Issue 1), 609-614*

609

A Comparative Study of Faculty Development Programs: A Case For the Application Of Web Scraping and Natural Language Processing

Section A-Research paper

I.INTRODUCTION

Education has been at the centre of human evolution. The progress that the world has seen in economic, social, political and other areas has been largely due to the role and the impact of education everywhere. Even in the most advanced countries, the role of education continues to be a significant component of planning for future growth and prosperity. In all of the educational institutions of the world, the primary focus is to have the very best of faculty to teach, undertake research, guide and mentor students and create the most conducive environment to learn and push the frontiers of arts, science, technology and other disciplines. Faculty development as an essential and a formal component of the academic process has evolved exceptionally well in nearly 100 years to meet the needs and challenges of education. This paper presents the results of an international comparison of faculty development. It also presents the use of machine learning concepts with Natural Language Processing to gather and analyze pertinent data on Faculty Development.

II.FACULTY DEVELOPMENT

Faculty development is a process aimed at preparing the faculty to be their best in teaching, student engagement and mentoring, research and academic administration. More specifically, the Faculty Development Programs (FDP) may involve a series of planned activities to help individuals and teams to gain domain knowledge, technical and professional skills, ethical practice in teaching, unbiased attitude towards learners, understanding of broader societal values and behaviours, engaging and challenging learners of all ages to be critical thinkers and problem solvers, assessing the works and performance of all learners under varying circumstances, and being professional mentors. They may also involve promoting innovation in curriculum and

instructional material development, development and deployment of technologies for instruction, simulation of systems and functions, applied and fundamental research, and enhancing leadership skills to develop, implement and administer academic programs.

Faculty development is an ongoing activity in all established institutions around the world. In India, the Central and the State Governments along with the private sector institutions have been allocating substantial resources for education at all levels [1]. In addition, the grants provided by the governmental agencies for developmental activities have been increasing at a rate of about 25% or more annually in recent years. Combined with the investments by the Deemed to be private universities and industry, the FDP in India has been a major undertaking to develop the country's human resource needs.

In the USA, a larger proportion of funding for FDP has been the responsibility of the individual institutions. However, organizations such as the National Science Foundation, the US Department of Education and such other agencies as the Department of Defence provide substantial grants for curriculum, faculty and research development. Around the world, the funding and the institutional support for FDP vary widely. While countries such as China, Saudi Arabia and others allocate substantial funding for FDP, it is generally insufficient or totally lacking in the other parts of the world.

III. RESEARCH THE METHODOLOGY

This research attempts to compare the FDPs in India and the USA. The rationale for the study is based on the fact that while India accounts for the largest number of universities in the world, the US universities are recognized as the academic leaders in the world [2]. More than 50% of the top 100 institutions in the QS world

Eur. Chem. Bull. **2023**,*12(Special Issue 1), 609-614*

610

A Comparative Study of Faculty Development Programs: A Case For the Application
Of Web Scraping and Natural Language Processing

Section A-Research paper

ranking are in the USA [3]. Further, India sends the second largest number of international students to the USA making it essential to look at various factors contributing to such student mobility and excellence in education.

Since the established universities around the world conduct their FDPs through their Centres for Teaching and Learning, this research focuses on the FDP practices in those centres in India and the USA. The research involves two steps. The first is to utilize machine learning tools with Natural Language Processing (NLP) to gather and compare data on the most prominent FDP activities in the Centres of Teaching and Learning in both countries. The second is to utilize the data to formulate a survey of faculty on their perception of the impact of FDPs. The framework for the research is presented in Figure-1.
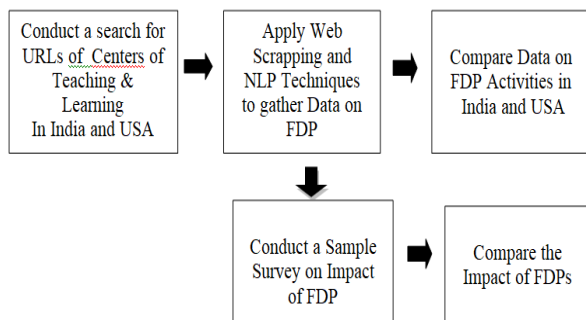
Figure 1: Framework for NLP Application for International Comparison of Faculty Development Programs

As shown in the figure, the process starts with the web search of the Centres of Teaching and Learning in India and the USA. Once a pre-determined number of centres are identified, web scrapping and NLP techniques are used to gather data on the most prominent faculty development activities in those centres. The output provides the data for the first level of comparison. With the data on the FDP activities, the second part of the study is made in the form of a survey research of faculty in both countries. The study in this part involves a random sample of faculty in both

countries and the use of a questionnaire to gather faculty perceptions on the impact of FDPs.

A. NLP Application With Web Scraping

This study utilizes NLP with web scraping techniques. For web scraping, the websites that are related to teaching and learning in the public domain are searched. Once identified, permission is sought to get into the sites one at a time. Once inside a given teaching and learning website, the FDP activities (according to the predefined words such as workshop, curriculum development, etc.) are searched. Using the Python Library "Beautiful Soup" or "Scrappy", the faculty development activities are extracted. They may be in the form of text or text strings. The data are then stored in Pandas "Data Frame". Using another Python library, the "Regular Expression Module", the data are organized into a useful format and carried forward for further analysis. The web scraping process resulted in gathering data from about 50 teaching and learning centres each in the USA and India. The results are presented in this section.

IV. RESULTS
A. Web Scraping of Faculty Development Programs in the USA

Web scraping of centres for teaching and learning in the USA was done through the Google Search Query by specifying the keyword and number of pages to be scraped. Figure -1 presents a partial list of centers in the USA.

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ENTER SEARCH KEYWORDS: Center for Teaching and Learning in USA
https://teaching.washington.edu/
Center for Teaching and Learning
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https://ctl.stanford.edu/
Center for Teaching and Learning
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https://www.colorado.edu/center/teaching-learning/
Center for Teaching & Learning | University of Colorado Boulder
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Figure 1: Retrieving the Link to the Centres for Teaching and Learning in USA

Eur. Chem. Bull. **2023**,*12(Special Issue 1), 609-614*

611

A Comparative Study of Faculty Development Programs: A Case For the Application Of Web Scraping and Natural Language Processing

Section A-Research paper

The Dataset with the centre names and the website links to perform web scrapping to identify the major FDP activities in those centers are presented in Figure -2.

Figure 2 – Data Frame with Web Links for the Teaching and Learning Centers in the USA

Presented in Figure -2 is a data frame with a partial list of centers studied. The process that was undertaken resulted in a list of 49 centers making it as an excellent representation of teaching and learning centers in the US universities and colleges.
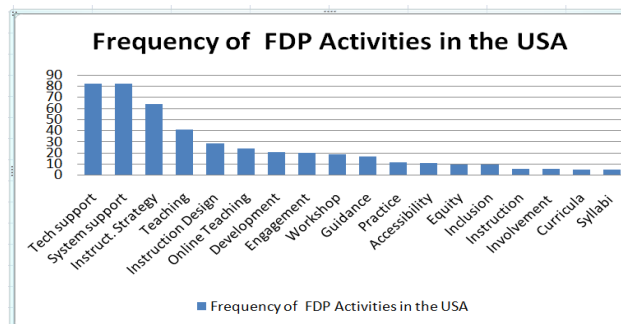

Figure-3: Web Scrapping Results on FDP Activities in the US Universities

Web scraping technique was applied to each of these centers with the website link stored in the URL column of the dataframe to extract the FDP activities undertaken in these centers. The data gathered from the process are presented in Figure -3. It is quite evident from the results that most frequent FDPs in the USA dealt with support services used by the faculty for teaching, instructional delivery and other functions. There were only a handful of programs on curriculum or syllabi related development activities.

B.Web Scraping of Faculty Development Programs in India

Utilizing the same methodologies used for web scraping FDPs in the USA, the websites of the Indian Centers for Teaching, Learning and Training were scraped. The resulting data frame with URLs are presented in Figure -4.

Figure 4:
Data Frame with Web Links for the Teaching, Learning and Training Centers in India

In carrying out the web scraping process, the number of institutions was kept in the same range as the USA. Figure -4 presents a partial list of URLs for the centers in the Indian colleges and

Eur. Chem. Bull. **2023**,*12(Special Issue 1), 609-614*

612

*A Comparative Study of Faculty Development Programs: A Case For the Application
Of Web Scraping and Natural Language Processing*

Section A-Research paper

universities. As the next step, NLP techniques were used to determine the most frequent activities in the Indian institutions. The results coming from the web scraping process are presented in Figure -5.
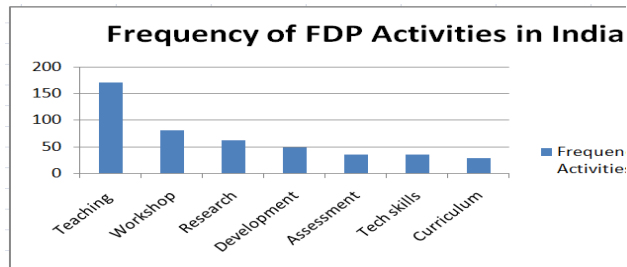
Figure-5: Web Scrapping Results on FDP Activities in India

The results of the study indicate that in India the most prominent FDP activity has been teaching. While workshops on various subjects, research and related development have seen a moderate number of activities, curriculum related FDPs have been minimal.

C. Comparison of FDP Activities in the USA and India

The results derived from the web scraping of the Centers of Teaching and Learning for both countries were compared. In doing so, only those activities that were common to both were taken into account. Table -1 presents the data.

FDP Activities	Most FreqFDPs in the USA	Most Freq FDPs in India
Tech support	82	35
Teaching	41	170
Development	21	48
Workshops	19	80
Curricula	5	28

Table -1 Comparison of FDPs in the USA and India

The data on the FDP activities, derived from the web scrapping process, were analyzed using statistical techniques. The results indicated that there was a significant difference between the activities in both countries. It is quite evident

from the data that while teaching, and the workshops related to subject areas are most frequent FDP activities in India, the FDPs in the USA on the other hand seemed to address such aspects as teaching strategies, and technical and system level support for the faculty.

D. Comparison of the Impact of FDPs in the USA and India

As a follow up to the work on the comparison of the FDP activities in the USA and India, it was decided to look into the impact of FDPs. It was also decided to use survey research methodologies to gather data and analyze. In both cases, the population consisted of faculty members from engineering and technology programs. For the purposes of this survey, a sample of 320 members were selected from the professional faculty rosters of US universities. The questionnaire survey received response from 59 faculty members. In the case of India, a randomly selected pool of 360 national level participants of a series of FDPs was used for the survey. The survey research process resulted in getting a response from 53 members. Although the survey was comprehensive and covered a number of topics, the results reported in Table -2 are limited to the faculty perception on the impact of FDPs.

Perception of Faculty on FDPs	Positive Perception of Faculty	
	US Faculty N= 59	Indian Faculty N= 53
Helpful in planning to teach a new course	17	32
Useful in developing strategies to teach	36	21
Useful to incorporate technologies in teaching	24	19
Useful in preparing to teach online courses	21	34
Helpful to use learning management systems	21	35
Helpful to increase student engagement	35	27
Useful in carrying out online assessments	29	30
Helpful to teach new subject areas	15	31
Helpful in building a professional network	22	32
Helpful to implement accreditation measures	27	29

Table -2 Faculty Perception on the Impact of FDPs

An analysis of the perception of faculty on the impact of FDPs in a limited number of areas presented in table -2 indicate that there is no significant statistical difference between the US

Eur. Chem. Bull. **2023**,*12(Special Issue 1), 609-614*

613

A Comparative Study of Faculty Development Programs: A Case For the Application Of Web Scraping and Natural Language Processing

Section A-Research paper

and Indian faculty. Given the smaller number of survey respondents, the survey may have to be extended to a larger pool to validate the results.

V.CONCLUSIONS

Application of Web Scraping and NLP techniques to study faculty development programs in two countries indicates that opportunities are there to undertake such research for global comparisons. Further, combining the results of both elements of the study, the conclusion is that although there are significant differences in the activities undertaken for faculty development in both countries, such differences do not seem to exist in the perception of the faculty towards the impact of FDPs. With these preliminary results, it is clear that the study should be extended further to compare FDPs in other parts of the world and identify highly effective methods to implement.

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Eur. Chem. Bull. **2023**,*12(Special Issue 1), 609-614*

614