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Research Article

Enhancing Education for Undergraduate Students of Computer Science through Mentoring: A Big Data Analytics Approach

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ABSTRACT

In the arena of computer science tutoring at the undergraduate level, mentorship programs have become an essential tool for professional and academic growth. This study examines the critical role that mentoring plays in improving computer science students' educational experiences and offers a cutting-edge strategy that makes use of big data analytics to maximize these mentorship programs. Educational institutions can obtain deeper insights into mentoring's impact on pupils' learning outcomes, skill development, and motivation by gathering and evaluating large amounts of data, including academic performance measures, program participation, and qualitative feedback. This data-driven strategy provides a road map for enhancing mentorship programs and, eventually, raising the standard of undergraduate computer science education, guaranteeing that students are equipped to tackle the demands of a quickly changing field. Sustainable Development Goal (SDG) 8 has also relevance with the enhancing education for students.

Keywords—mentoring; big data; SDG; students; education; big data analytics

INTRODUCTION

Nowadays, there is a period of extraordinary expansion and invention in the arena of computer science. For undergraduates seeking computer science degrees, this dynamism offers great potential, but it also brings with it several difficulties. A thorough and organized educational strategy is necessary to guarantee that these pupils are ready for the demands of the industry. Offering mentorship is one of the best ways to improve undergraduate computer science education.

Higher education mentoring programs are becoming more widely acknowledged as essential tools for assisting students in navigating their academic paths and settling into careers. Mentoring is far more important when it comes to computer science education. With technology changing so quickly and computer science becoming more and more diverse. It could be challenging for students to stay up to date on the newest advancements and gain the skills they need to compete in a highly competitive employment market. Thus, mentoring becomes a guiding light that provides both academic assistance and opportunities for personal and professional growth.

This study explores how mentorship plays a crucial part in improving undergraduate computer science education. It emphasizes the substantial effects mentoring programs can have on students' academic achievement, skill growth, and motivation in this sector. Moreover, it presents a novel mentoring approach viewed via the prism of big data analytics. Educational institutions can enhance their mentorship programs and better address the unique requirements and obstacles encountered by computer science students by utilizing data-driven insights. To highlight the potential of big data analytics to further improve this crucial component of undergraduate education, this study attempts to present a thorough understanding of the symbiotic link between mentoring and the computer science educational experience.

SIGNIFICANCE OF MENTORING FOR UNDERGRADUATE STUDENTS

A. Academic and Career Guidance

Academic mentoring guarantees learners receive assistance with course selection and academic scheduling. Career mentoring helps pupils get ready for internships and job opportunities by guiding them through the complexities of the job market.

1) ***Course Selection:*** Mentors help students select courses and career pathways that will best suit their academic and professional objectives.
2) ***Study Strategies:*** Mentors offer advice on organizing time, productive study methods, and tools that can help learners succeed in their computer science classes.
3) ***Problem-Solving:*** Learners may talk about difficult academic issues, look for clarification on confusing ideas, and develop a deeper understanding of the subject matter through mentoring.
4) ***Industry Insights:*** Since mentors frequently have practical experience in the computer science field, they can provide insightful advice on current trends, market demands, and possible career paths.
5) *Internship and Job Placements:* Mentors can help learners find and apply for co-ops, internships, and jobs. By giving them hands-on knowledge, such possibilities will improve their employability.
6) ***Networking:*** Professional organizations can benefit from mentoring relationships as they give students access to professionals in the field, enable them to investigate career options, and establish important industry contacts.

B. Skill Development

Critical thinking, problem-solving, and technical skills are all developed by mentors and are essential to the computer science field.

1) ***Programming Proficiency:*** Students can become skilled developers with the help of mentors who can offer practical guidance in programming languages, algorithms, and coding methods.
2) ***Problem-Solving:*** Mentors help students apply their knowledge to practical issues and hone their problem-solving abilities by providing them with circumstances of solving problems in reality.
3) ***Technology Mastery:*** Mentors ensure that learners are adequately prepared to adjust to developments in the industry by providing them with the most recent tools, frameworks, and software as technology advances.
4) ***Teamwork and Collaboration****:* In an industry where collaboration is the norm, mentors play a crucial role in helping learners build the interpersonal skills necessary for collaborative tasks and teamwork.
5) Project Development and Management: Mentors assist students in developing the skills necessary to organize, carry out, and complete software projects successfully by guiding them by means of the process.

C. Encouragement and Motivation

Mentoring lowers attrition rates in computer science programs by giving learners emotional support and motivation.

1) **Personalized Support:** Based on each student's particular needs and difficulties, mentors give them individualized attention while providing them with emotional support and guidance. This kind gesture can be a very effective motivator.
2) **Setting Realistic Goals:** Students can set realistic career and academic goals with the assistance of mentors. These objectives serve as motivators by giving people a feeling of purpose and direction.
3) **Overcoming Challenges:** Students studying computer technology frequently run into challenging issues and obstacles. Mentors help students overcome obstacles by providing direction and counsel, avoiding discouragement from failures.
4) **Confidence Building:** Mentors help pupils develop their sense of self-worth by reassuring and validating their skills. Gaining self-assurance can be crucial in conquering self-doubt and imposter syndrome.
5) **Professional Development:** By talking with students about their long-term professional goals, mentors can assist them in seeing the wider picture. This proactive strategy encourages motivation by linking academic achievement to future achievement.

BIG DATA ANALYTICS IN EDUCATION

A. Role of Big Data Analytics

Student data analysis may increase decision-making and enrich educational experiences. Big data analytics is altering the education sector by giving data-driven insights.

1) ***Improved Matching of Mentors and Mentees:*** Schools are better able to match students with mentors who have appropriate experience and shared interests when they analyze data on students' academic goals, hobbies, and learning styles. This guarantees a more fruitful and successful mentoring encounter.
2) ***Personalized Mentorship Plans:*** Big Data analytics enables mentors to design unique mentoring programs for every mentee. Mentors can adapt their guidance and support to meet particular obstacles and goals by monitoring each student's progress and requirements.
3) ***Early Intervention and Support:*** Students who could be at risk of performing poorly or having difficulties can be identified using big data analytics. This information can be used by mentors and

organizations to offer early intervention and support, helping students remain on course both psychologically and intellectually.

4) *Feedback* Analysis: The efficacy of the mentorship program can be determined by analyzing comments from mentors and mentees with the aid of big data analytics. This analysis's results may result in best practices and program enhancements.

METHODOLOGY

A. Data Collection

Use a survey form to collect student data from computer science undergraduates at a private university.

- Academic transcripts
- Involvement in mentoring programs

The act of obtaining, documenting, and preserving information, facts, or observations for analysis, investigation, or decision-making is known as data collecting. It is a crucial stage in research, business, and many other domains since it offers the foundation for coming up with ideas, choosing wisely, and drawing conclusions.

1) A couple of crucial steps are usually involved in data collection:

a) *Defining Objectives:* Clearly state the aims and purposes of the data-gathering procedure. What data is required, and how will it be put to use?

b) *Selecting Data Sources:* Ascertain the source of the data. Surveys, interviews, observations, papers, databases, sensors, and other methods can all be used as data sources.

c) *Designing Data Collection Instruments:* Make the equipment or procedures required for data collection. This may entail creating questionnaires, observation checklists, interview protocols, surveys, or data collection forms.

d) *Data Gathering:* Gather information from the selected sources. This could entail gathering data from records or databases, and performing surveys, interviews, or observations.

e) *Data Entry and Management*: For additional processing, data might require to be input into electronic databases or spreadsheets. Storage, cleaning, and quality assurance are all part of data management.

B. Data Analysis

Use machine learning algorithms to find relationships between academic achievement and guidance. Examine mentor and student responses to determine the qualitative effects of mentoring.

"Data analysis" is the act of looking through, organizing, analyzing, and interpreting data to find patterns, trends, and insights that are important. To extract useful knowledge from data that may be utilized for research, problem-solving, or making educated decisions, a variety of approaches, methods, and tools are employed. Numerous data kinds, such as numerical, textual, category, or visual data, can be subjected to data analysis.

1) Important elements of data analysis consist of:

a) *Data Cleaning:* This process entails locating and fixing data mistakes, outliers, missing numbers, and anomalies to guarantee accuracy and dependability.

b) *Data Transformation:* To prepare data for analysis, transformations are frequently applied. Data aggregation, summarization, and format conversion are a few examples of this.

c) *Qualitative Data Analysis*: Qualitative data analysis techniques, such as content evaluation or theme coding, are used to draw conclusions from unstructured data, which is textual or non-numerical in nature.

d) *Big Data Analysis:* Big data has led to the usage of specialized tools and technologies, such as distributed computing, NoSQL databases, and data processing frameworks like Hadoop, for managing and analyzing huge amounts of data.

C. Result

TABLE I. FEEDBACK

Total	**Boys**	**Girls**	**Total**
Weekly-yes	11	12	23
Weekly-partially	6	1	7
Bi-weekly-yes	5	0	5
Bi-weekly-partially	7	7	14
Monthly-yes	1	1	2
Monthly-partially	10	5	15

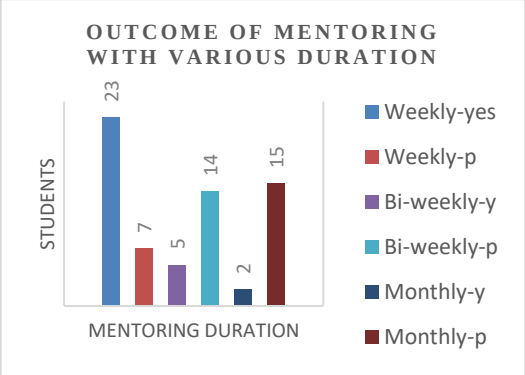

Fig. 1. Outcome of Mentoring

The above chart depicts that improvement can be noticed in more number of students who have attended mentoring sessions on weekly basis as compared to bi-weekly and monthly basis. In total, 66 students opted for mentoring session out of which 30 students chose weekly mentoring, 19 candidates gave priority to bi-weekly sessions, and 17 learners attended monthly mentoring.

RELEVANCE BETWEEN SDG AND MENTORING

The endeavor to progress the study of computer science for undergraduate learners through mentorship utilizing a Big Data Analytics methodology is directly related to the United Nations Sustainable Development Goal (SDG) 8, "Decent Work and Economic Growth."
This is the way they are related to one other:

A. ***Skill Development for Employability:*** Improving undergraduate computer science education is to provide students with the essential information and skills to flourish in the workforce. This is in line with the objectives of SDG 8, which encompass both efficient functioning and full employment, Great work for everyone, and sustained, inclusive, and sustainable economic growth. This effort helps to lower unemployment rates and create decent career possibilities by increasing the employability of computer science graduates.
B. ***Career Guidance and Readiness:*** In order to adequately prepare students for their future occupations, mentoring is essential. It supports individuals in making well-informed choices regarding their career and academic paths. The mentoring process may be made more efficient by using big data analytics, guaranteeing that students receive career-aligned counsel and support that is specifically suited to them. This strengthens SDG 8's emphasis on encouraging youth employment by facilitating a smoother transition from school to the workforce.
C. ***Reducing Skills Mismatches:*** The gap in the workforce's capabilities and the demands of the labor market is one of the obstacles to decent work and economic progress. Through the use of Big Data Analytics, mentorship programs and educational institutions can learn more about the talents that the computer science industry requires. By using this data, the curriculum may be more closely aligned with industry demands, which will lessen skill gaps and promote economic expansion.
D. ***Fostering Innovation:*** The vanguard of innovation is the field of computer science. Learners are encouraged to think creatively and provide innovative answers to issues that they face in the real world by using Big Data Analytics and mentoring to improve education. By advancing technology, which is necessary for countries and industry to stay competitive in the global market, this promotes economic growth.
E. ***Building a Skilled Workforce:*** SDG 8 highlights how crucial a workforce that is knowledgeable and flexible is to sustaining economic growth. The mentoring strategy contributes to the development of a pool of knowledgeable, flexible, and highly educated computer science workers who are also well-versed in the needs and trends of the industry, making them marketable hires.

FUTURE SCOPE

Subsequent investigations ought to concentrate on executing the suggestions for improving the mentoring program and evaluating their influence on academic results. Furthermore, one intriguing area for additional research is the application of machine learning and artificial intelligence to offer more individualized mentoring experiences.

CONCLUSION

An essential part of the undergraduate computer science curriculum is mentoring. Institutions can better comprehend the needs and advantages of mentorship programs by utilizing big data analytics. This study has demonstrated the beneficial effects of mentorship on students' motivation, skill development, and academic

achievement. Educational institutions can further improve the efficacy of their mentorship programs and offer more specialized help to their computer science students by utilizing big data analytics.
The application of big data analytics in combination with mentorship programs has unlocked a multitude of insights, opportunities, and game-changing possibilities in the quest to improve undergraduate computer science education. Recognizing the value of skill development, encouragement, inspiration, and advice for both academic and career goals, this study work set out to investigate the complex dynamics of mentoring within the field of computer science. We have examined how mentoring affects undergraduate students' educational experiences using a mix of data from mentorship programs, academic records, and qualitative comments.

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