Chapter 5

Research Analysis, Future Work and Conclusion

5.1 Introduction

The research work titled “An Algorithmic Approach for Undergraduate Computer Science Students to Select Mentor using Recommendation System of Machine Learning” addresses the pressing need for innovative and data-driven mentorship programs. While substantial progress has been made globally in developing mentorship frameworks, many existing systems struggle to effectively personalize and enhance mentor-mentee interactions. Mentorship is a crucial aspect of personal and professional development, encompassing diverse dynamics such as skill transfer, career guidance, and emotional support. Despite its importance, there is a noticeable lack of research and tools that tackle the common challenges of mismatched pairings, insufficient personalized guidance, and inadequate tracking of mentorship progress.

To bridge this gap, the researcher has developed a robust machine learning model designed to accurately classify and match mentors and mentees based on their attributes and responses to specific questions. This system aims to accommodate the multifaceted needs of mentorship programs and significantly enhance their effectiveness and scalability. The machine learning model leverages historical data and patterns to predict optimal mentor-mentee pairings, continuously monitor the progression of relationships, and provide actionable insights for improvement.

The development of this system holds the potential to transform traditional mentorship programs by introducing a data-driven approach that ensures more compatible and rewarding mentorship experiences. This thesis concludes with a comprehensive summary of the main findings, an in-depth performance evaluation, and a discussion of the overall impact of the research. Additionally, it outlines future research directions, including the exploration of advanced machine learning models, real-time feedback mechanisms, and ethical considerations to preserve the human elements in mentorship.

5.2 Information Gathering and Assessment

By using a machine learning model, the researcher has determined and concentrated on maximizing mentor-mentee interactions. A large dataset of mentorship-related data was gathered from a wide range of participants in order to assess and improve this model. In particular, the dataset includes 5,139 samples, comprising 4,639 students and 481 mentors, guaranteeing a comprehensive depiction of mentor-mentee relationships.

The samples were carefully selected from a variety of sources, such as publicly accessible information, organizational mentorship programs, and online mentorship platforms. To guarantee that the dataset appropriately reflects the vast variety of mentorship settings, participant histories, and unique traits, this diversity of data sources was crucial.

The performance of the model was evaluated using all of the data that was gathered. The research guarantees a comprehensive and methodical examination of the model's correctness, speed, and general efficacy in categorizing and pairing mentors and mentees by utilizing a strict evaluation procedure. By using this method, the model may go through a thorough learning process and correctly match mentors and mentees according to their characteristics and answers to particular questions.

5.3 Performance Analysis of Model and Outcomes

The suggested Mentor Buddy Matching Model's accuracy, effectiveness, and resilience in finding compatible mentor-mentee pairings under varied circumstances are assessed using performance analysis. This section examines the model's performance using a range of test scenarios, assessment parameters, and comparison analysis. We pay particular attention to the following areas: prediction efficiency with various data properties, demographic-specific performance, matching efficacy, and categorization accuracy.

5.3.1 Mentor - Mentee Ratio

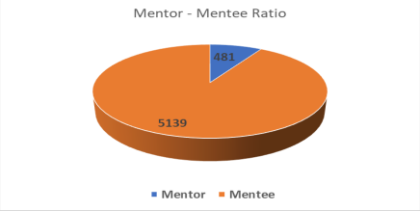

Figure 5. 1: Mentor – Mentee Ratio

5.3.2 Categories of questionnaire

5.3.2.1 Category – 1

- Table: Category 1 - Do you skip meals?

The responses to the Category-1 questionnaire on the fundamental question "Do you skip meals?" provide a revealing look into the eating habits of both students (mentees) and mentors. The survey presented four options: 1. *Not at All: Without Meals it is hard to survive*, 2. *Sometimes*, 3. *Yes*, and 4. *None*. Among the students, **1,322** individuals selected option 1, indicating their strong adherence to regular meals. A substantial number, **3,027**, chose option 2, suggesting they skip meals *Sometimes*, while **228** admitted to regularly skipping meals (option 3) Only a small group of **81** selected option 4 (*None*), signaling their indifference to the subject. In total, the student responses sum up to **4,658**. Meanwhile, the mentors also offered their perspectives: **112** strongly affirmed regular meals (option 1), **338** admitted to skipping meals occasionally (option 2), **30** said they skip meals regularly (option 3), and only **1** expressed complete disregard (option 4). This results in a total of **481** mentor responses. Combined, the total responses from both mentees and mentors amount to **5,139**.

Table 5. 1: Category-1

	Not at All.. Without Meals it is hard to survive	Sometimes	Yes	None
Student	1322	3027	228	81
Mentor	112	338	30	1

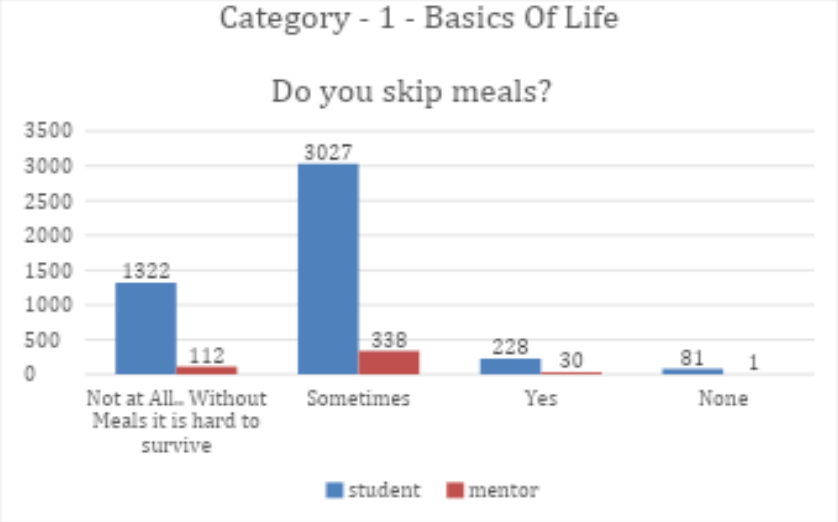

Figure 5. 2: Basics of Life

The outcome of incorporating such behavioral and lifestyle data into the matching process is a robust and highly personalized matching system. It strengthens mentor-mentee bonds, supports better engagement, and ensures alignment in perspectives, ultimately enhancing the effectiveness of the mentoring program. Additionally, leveraging these insights enables the organization to promote healthy lifestyle practices, addressing issues such as meal-skipping that could stem from stress, time management challenges, or other factors, contributing to a more supportive and balanced community overall.

5.3.2.2 Category – 2

- Table: Category 2 - How would your friends describe you?

The responses to the Category-2 questionnaire, which aims to understand the nature of mentors and mentees through a variety of questions, provide valuable insights into personality traits as perceived by peers. One such question, "How would your friends describe you?" offered four options: 1. *Loyal*, 2. *Reactive*, 3. *Sensitive*, and 4. *Trustworthy*. Among the student (mentee) group, **870** respondents identified themselves as *Loyal* (option 1), **233** selected *Reactive* (option 2), **515** chose *Sensitive* (option 3), and a striking majority of **3,040** felt that *Trustworthy* (option 4) best described them. This brought the total student responses to **4,658**. On the other hand, the mentor group had **71** participants selecting *Loyal* (option 1), a mere **5** identifying as *Reactive* (option 2), **85** choosing *Sensitive* (option 3), and a significant **320** aligning themselves with the *Trustworthy* trait (option 4), leading to a total of **481** mentor responses.

Table 5. 2: Category-2

	Loyal	**Reactive**	**Sensitive**	**Trustworthy**
Student	870	233	515	3040
Mentor	71	5	85	320

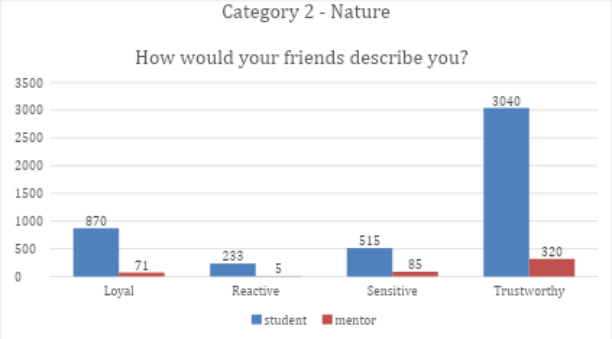

Figure 5. 3: Nature

5.3.2.3 Category – 3

- Table: Category 3 – Do you express your feelings?

The questionnaire under category-3 delves into the expression of feelings among mentors and mentees, shedding light on their emotional communication dynamics. Respondents were asked, "Do you express your feelings?" with four options to choose from: 1) Hardly, 2) No, 3) Sometimes, and 4) Yes. Among mentees, the responses were distributed as follows: 1,076 selected "Hardly," 566 chose "No," 1,648 opted for "Sometimes," and 1,368 selected "Yes." This amounts to a total of 4,658 responses from mentees, emphasizing a diverse range of emotional expressiveness within the group. On the other hand, mentors exhibited a smaller yet significant response pool: 105 mentors selected "Hardly," 32 chose "No," 198 opted for "Sometimes," and 146 selected "Yes." Collectively, this totals 481 responses from mentors. By comparing these figures, it is evident that both mentees and mentors experience varying levels of comfort in expressing their feelings, with a notable inclination among the majority of mentees (1,648) and mentors (198) to occasionally express their emotions ("Sometimes"). Interestingly, the affirmative choice of "Yes" is also prevalent, highlighting a willingness in both groups to engage in emotional expression, though the numbers suggest mentees are more expressive overall compared to mentors. This data underscores the importance of fostering open emotional dialogues within mentorship frameworks.

Table 5. 3: Category-3

	Hardly	No	Sometimes	Yes
Student	1076	566	1648	1368
Mentor	105	32	198	146

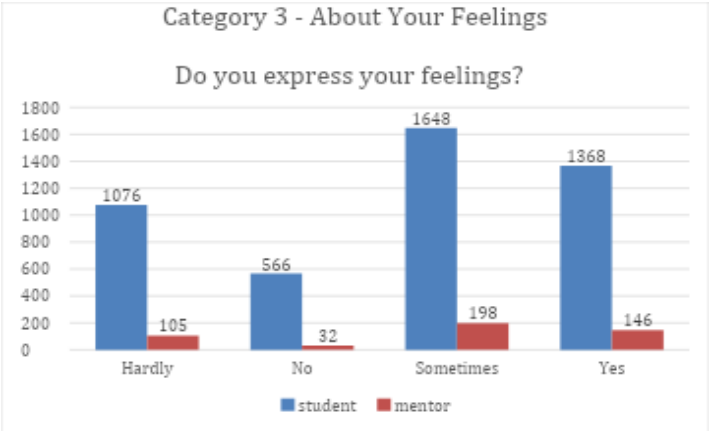

Figure 5. 4: About Feelings

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5.3.2.4 Category – 4

- Table: Category 4 – How often do you enjoy caring for others?

Category-4 of the questionnaire explores the empathy levels among mentors and mentees, focusing on their enjoyment in caring for others. The specific question, "How often do you enjoy caring for others?" presented four options: 1) Always, 2) Never, 3) Rarely, and 4) Sometimes. Among the mentees, an overwhelming majority of 3,499 selected "Always," reflecting a significant level of empathy and care within the group. Additionally, 82 mentees selected "Never," 231 chose "Rarely," and 846 indicated "Sometimes." This results in a total of 4,658 responses from mentees, underlining their strong inclination towards caring for others. In the mentors' responses, 426 chose "Always," showcasing their high empathy levels, while no mentors selected "Never." Only 1 mentor selected "Rarely," and 54 chose "Sometimes." The total number of mentor responses stands at 481. Comparing these groups, both mentors and mentees predominantly leaned towards the "Always" option, suggesting a shared value of empathy and a genuine enjoyment in caring for others. However, the mentees' responses display a larger overall participation in this category. This data underscores the foundational role that empathy plays in the mentor-mentee relationship, contributing to a nurturing and supportive dynamic for personal and professional growth.

Table 5. 4: Category-4

	Always	**Never**	**Rarely**	**Sometimes**
Student	3499	82	231	846
Mentor	426	0	1	54

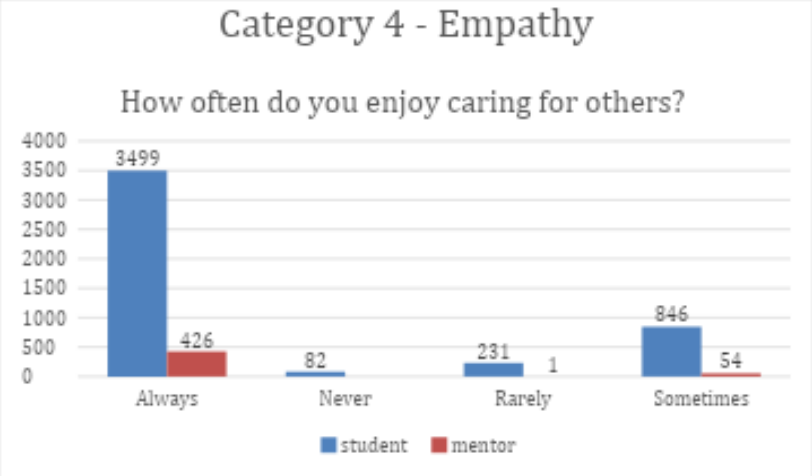

Figure 5. 5: Empathy

5.3.2.5 Category – 5

- Table: Category 5 – Which of the following skills, in terms of outdoor activities appeals to you the most?

Category-5 of the questionnaire investigates the appeal of different outdoor activity skills in shaping relationships within the mentor-mentee dynamic. Respondents were asked, "Which of the following skills, in terms of outdoor activities, appeals to you the most?" The options provided were 1) Relationship Management, 2) Self-regulation, 3) Self-awareness, and 4) Social Skills. Among the mentees, the response distribution was as follows: 1,295 selected "Relationship Management," 601 chose "Self-regulation," 1,255 opted for "Self-awareness," and 1,507 preferred "Social Skills." These figures amount to a total of 4,658 responses from mentees, indicating a strong collective interest across all options, with "Social Skills" gaining the highest preference. On the mentors' side, 169 selected "Relationship Management," 43 chose "Self-regulation," 210 selected "Self-awareness," and 59 opted for "Social Skills," bringing the total to 481 responses from mentors. While both groups show notable preferences, the data highlights distinct trends: mentors exhibit a stronger inclination toward "Self-awareness," with 210 responses, compared to their other choices, whereas mentees tend to favor "Social Skills," with 1,507 responses leading the chart. These insights reflect the varying priorities between mentors and mentees, emphasizing the importance of tailoring outdoor activities to foster these specific skillsets. The combined totals of responses underline the relevance of these skills in building and maintaining strong relationships, a cornerstone of effective mentorship programs.

Table 5. 5: Category-5

	Relationship Management	**Self-Regulation**	**Self-awareness**	**Social Skills**
Student	1295	601	1255	1507
Mentor	169	43	210	59

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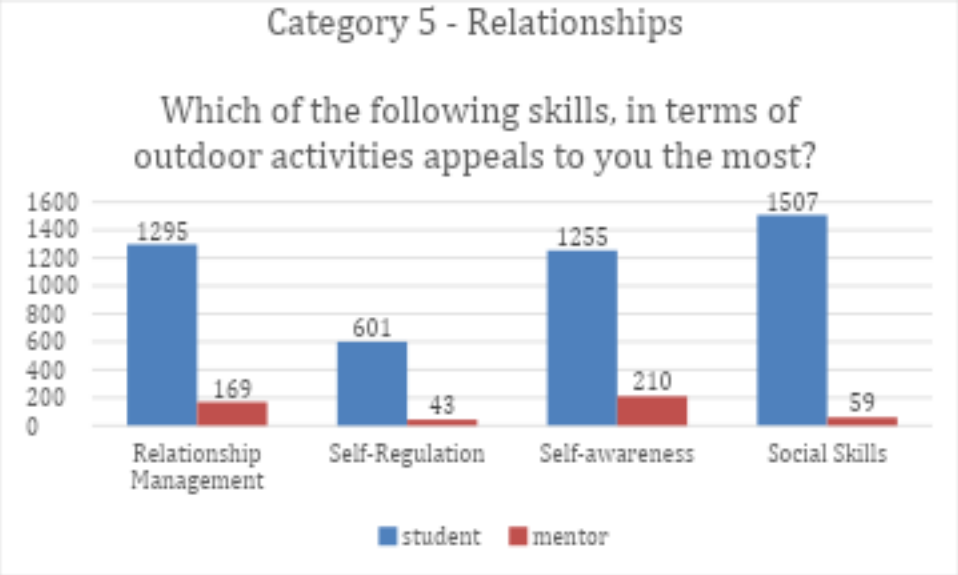

Figure 5. 6: Relationships

5.3.2.6 Category – 6

- Table : Category 6 – A failure is not a failure if you keep trying

Category-6 of the questionnaire examines the thinking patterns of mentors and mentees, particularly their perspectives on failure and persistence. The question, "A failure is not a failure if you keep trying?" offered four response options: 1) Failure is always a failure, 2) No, 3) Partly, and 4) Yes. Among the mentees, the responses were as follows: 730 chose "Failure is always a failure," 161 selected "No," 671 opted for "Partly," and an overwhelming 3,096 chose "Yes." This brings the total responses from mentees to 4,658, showcasing a strong collective belief in perseverance, as indicated by the significant preference for "Yes." On the mentors' side, no one selected "Failure is always a failure," while 57 opted for "No," 12 chose "Partly," and 412 selected "Yes." The mentors' total response count stands at 481, with the majority aligning with the "Yes" perspective, similar to the mentees. This data reflects a shared optimism and growth mindset within the mentor-mentee dynamic, emphasizing the importance of resilience and the view of failure as a stepping stone rather than a dead end. The significant leaning toward "Yes" among both groups highlights the value placed on perseverance as a critical life and professional skill, further reinforcing its significance in mentorship frameworks.

Table 5. 6: Category-6

	Failure is always failure	No	Partly	Yes
Student	730	161	671	3096
Mentor	0	57	12	412

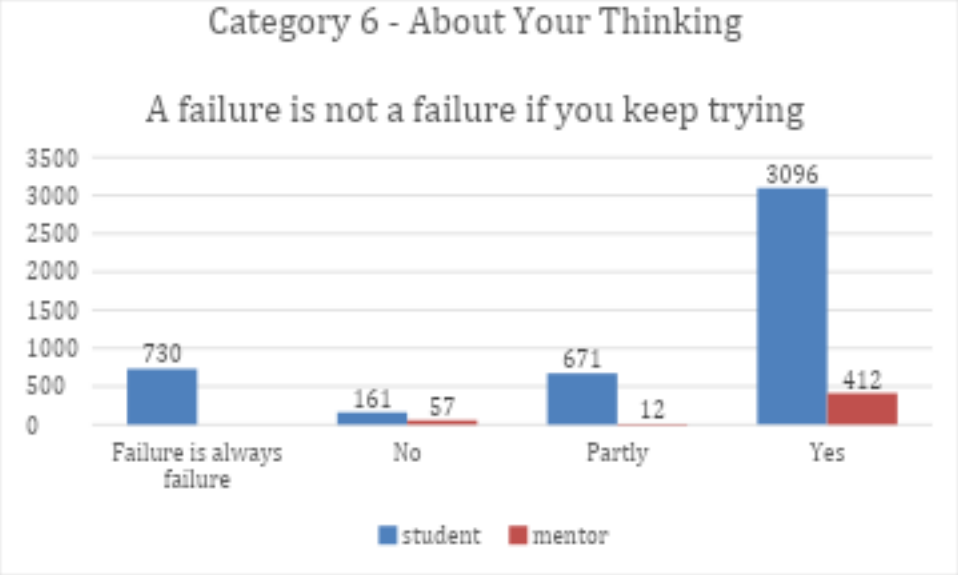

Figure 5. 7: About Thinking

5.3.2.7 Category – 7

- Table: Category 7 – How happy are you with everything in your life? (1 Lowest, 4 Highest)

Category-7 of the questionnaire focuses on self-assessment, exploring how mentors and mentees rate their happiness with everything in their lives. The question, "How happy are you with everything in your life?" provided a 4-point scale where 1 represented the lowest level of happiness and 4 the highest. Among the mentees, the distribution of responses is as follows: 156 selected option 1 (1-Lowest), 1,119 chose option 2, 2,004 selected option 3, and 1,379 selected option 4 (4-Highest), resulting in a total of 4,658 responses. The data reveals that a significant portion of mentees (2,004) rated their happiness at level 3, showing a generally positive outlook, with 1,379 mentees expressing the highest level of happiness. On the mentors' side, 2 selected option 1, 24 chose option 2, 312 opted for option 3, and 143 selected option 4, bringing the total responses to 481. The mentors predominantly rated their happiness at level 3 as well (312), with a notable number (143)

also expressing the highest happiness level of 4. Comparatively, mentees are more distributed across the scale, while mentors display a stronger focus on the higher ratings. Both groups seem to lean toward a positive self-assessment, with higher ratings (3 and 4) dominating the responses. This data highlights a shared general contentment among both mentors and mentees, reflecting their balanced and optimistic approach to life.

Table 5. 7: Category-7

	1	2	3	4
Student	156	1119	2004	1379
Mentor	2	24	312	143

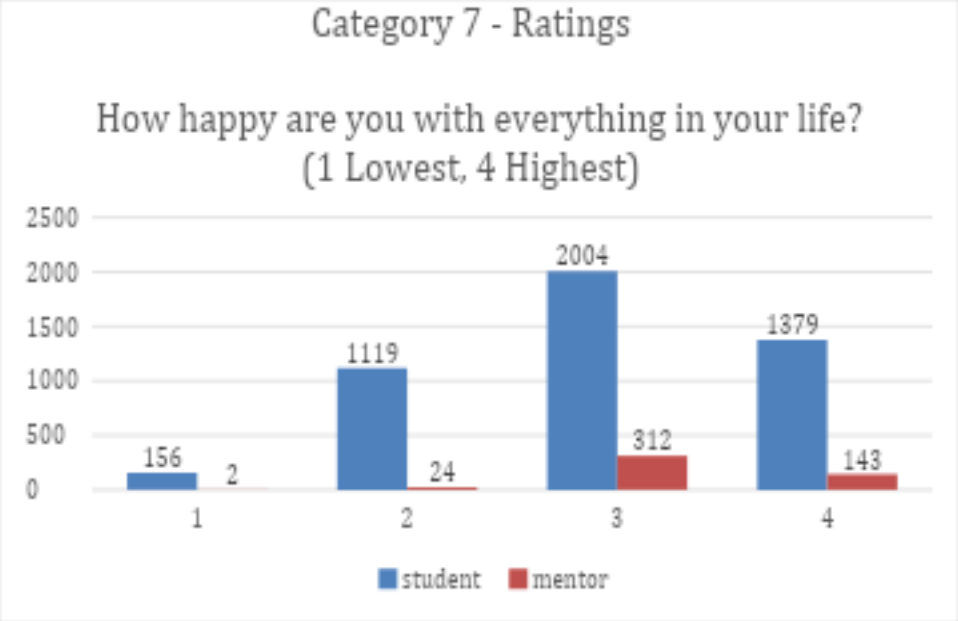

Figure 5. 8: Ratings

5.3.2.8 Category – 8

- Table: Category 8 – If you have asked to someone for pen to sign a paper. How will you return it?

Category-8 of the questionnaire utilizes case studies to better understand the nature and thinking patterns of mentors and mentees. One of the questions posed was, "If you have asked someone for a pen to sign a paper, how will you return it?" with four options: 1) Both Separate: Pen and Cap, 2) Closed Pen with Cap, 3) Keeping it into your pocket (Not Going to Return), and 4) Open Pen without Cap. Among mentees, the responses were distributed as follows: 423 selected option 1, 3,721 chose option 2, 57 opted for option 3,

and 457 chose option 4, resulting in a total of 4,658 responses. The majority of mentees (3,721) chose the second option, "Closed Pen with Cap," reflecting a preference for completeness and orderliness in returning items. On the mentors' side, the trend is similar, with 436 selecting option 2, while 14 chose option 1, 1 opted for option 3, and 30 selected option 4. The total number of mentor responses stands at 481. This alignment in trends between mentees and mentors highlights a shared inclination toward neatness and respect for borrowed items, as evidenced by the significant preference for "Closed Pen with Cap." Notably, the low count of responses for option 3 ("Not Going to Return") in both groups (57 mentees and 1 mentor) indicates a high level of integrity and honesty. Overall, these responses reflect a strong sense of responsibility and respect for social norms across both groups, aligning with the values often emphasized in mentorship relationships.

Table 5. 8: Category-8

	Both Separate: Pen and Cap	**Closed Pen with Cap**	**Keeping it into your pocket (Not Going to Return)**	**Open Pen without Cap**
Student	423	3721	57	457
Mentor	14	436	1	30

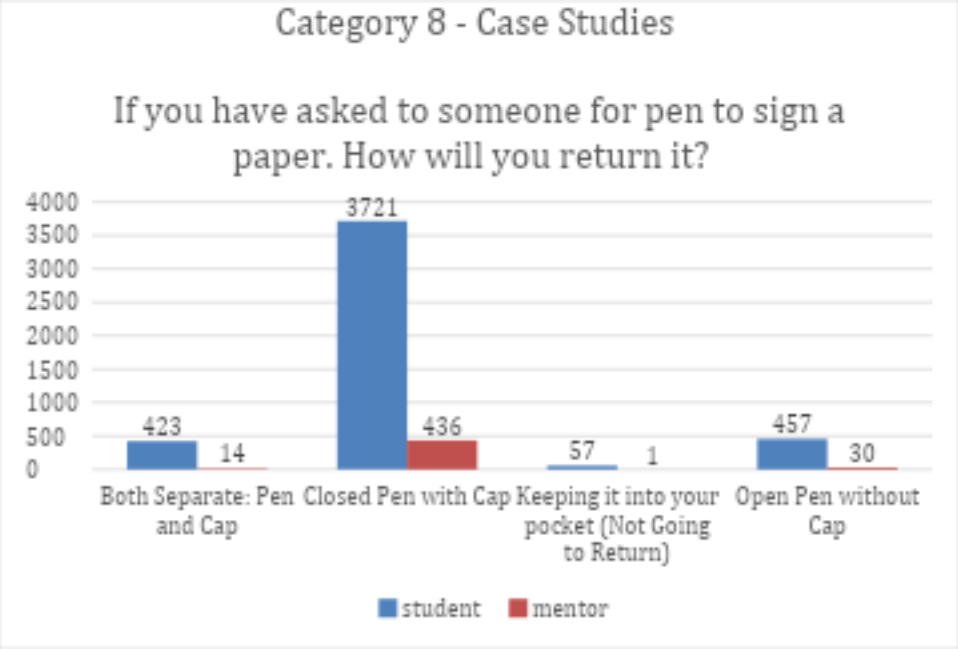

Figure 5. 9: Case Studies

5.4 Success Factors for Mentoring Programs:

If specific success factors are rigorously utilized, a mentoring program that pairs mentors and mentees according to how similar their answers to a predetermined set of questions are can become very successful. I list the main elements that can contribute to the program's success below:

5.4.1 Customized Pairing Using Matching Similarities

The core of the approach is the precise matching of mentors and mentees according to their responses, which reveal common viewpoints, beliefs, and behavioral patterns. The program makes sure that both parties are naturally in agreement with each other's ways of thinking and solving problems by utilizing maximum similarity ratings. Any mentoring relationship must have a natural rapport and mutual understanding, which are fostered by this alignment. Additionally, allowing mentees to choose between the top two mentors based on similarity scores guarantees a sense of independence and active involvement, which increases their zeal and commitment to the program.

5.4.2 Data-Informed Perspectives for Successful Matching

To achieve precision, similarity scores must be calculated using structured data analysis. A thorough profile of mentors and mentees is produced by the responses gathered from insightful surveys (e.g., regarding emotional expression, empathy, relationship-building, thinking processes, and happiness levels). The robustness and relevance of the matches are guaranteed by sophisticated algorithms and statistical models. Over time, matching accuracy can be improved by continuously improving the data and including new dimensions, such as preferences for learning techniques or communication styles.

5.4.3 Explicit Goals and Expectations

Establishing specific goals for the connection is crucial after the mentor-mentee pairing is confirmed. It is important to support mentors and mentees in talking about and reaching common objectives, whether they are related to skill development, career counseling, academic advancement, or emotional fortitude. Expectations that are in line guarantee that everyone stays dedicated and motivated, which improves the program's overall efficacy.

5.4.4 Constant Feedback System

To assess the success of the pairings and the mentoring process overall, a feedback loop is necessary. Frequent reviews, check-ins, and polls aid in spotting possible problems early on, such communication difficulties or incompatibilities. This guarantees a dynamic and flexible mentoring model by enabling program managers to re-calibrate pairings as needed.

5.4.5 Offering Assistance and Training

Mentors should receive training in essential mentoring qualities including empathy, active listening, and effective communication in order to increase the program's efficacy. A helpful framework that offers tools, direction, and continual training guarantees that mentors are prepared to carry out their responsibilities. Additionally, mentees must to get instruction on how to get the most out of their education and actively participate in the mentoring relationship.

The mentorship program can optimize the advantages of similarity-based matching while preserving the flexibility and adaptability required for long-term efficacy by giving priority to these success elements. These components work together to create a healthy mentoring ecosystem where mentees and mentors can develop and accomplish their objectives. If you require more information or would want to discuss any of these ideas in more detail, please let me know!

5.5 Future Expansion and Improvements

Using machine learning approaches to optimize mentor-mentee relationships has advanced significantly with the creation of the Mentor Buddy Matching Model. Future studies and improvements, however, have a lot of room to improve and broaden the model's capabilities. Future directions and possible areas for improvement are described in this section:

5.5.1 Sophisticated Models for Machine Learning

The application of more complex algorithms, including deep learning models and neural networks, may be investigated in future studies. Even more precise mentor-mentee pairings could result from these sophisticated algorithms' capacity to identify intricate patterns and

connections in the data. Furthermore, applying ensemble learning strategies can improve the model's prediction capabilities even further.

5.5.2 Mechanisms for Real-Time Feedback

Mentorship connections could be continuously monitored and improved by incorporating real-time feedback systems into the model. The software might dynamically modify pairings and offer practical insights to address new requirements and issues by gathering and evaluating feedback from mentors and mentees over the course of the mentorship period.

5.5.3 Extension to Other Fields

The model's use and advantages could be expanded by adapting it for different fields and sectors. The efficiency of the concept can be increased by customizing it to particular domains, as each industry may have distinct mentorship needs. For instance, tailored algorithms that take domain-specific variables into consideration may be advantageous for mentorship programs in the fields of business, education, technology, and healthcare.

5.5.4 Including Other Sources of Information

In order to enrich the dataset, future improvements can include adding other data sources. For example, combining information from professional networking sites, social media, and other online sources may offer a more thorough understanding of the histories, passions, and career paths of participants. More sophisticated and successful mentor-mentee pairings may result from this enhanced data.

5.5.5 Ethical Issues and the Reduction of Bias

Ensuring fairness and openness in the model's decision-making process requires addressing ethical issues and reducing biases. Future studies might concentrate on creating methods for recognizing and getting rid of prejudices based on gender, race, ethnicity, and other variables. To keep participants' trust, maintaining data privacy and confidentiality is also of utmost importance.

5.5.6 Improved User Experience and Interface

The Mentor Buddy Matching Model's usability and accessibility can be improved by making improvements to its user interface and experience. Program coordinators and participants may find it simpler to interact with the model and understand its recommendations if user-friendly dashboards, visualizations, and interactive tools are developed.

5.5.7 Impact Assessment and Longitudinal Research

Important insights can be gained by carrying out longitudinal studies to evaluate the Mentor Buddy Matching Model's long-term effects on participants' professional and personal development. Assessing the model's efficacy over time can confirm its contributions to mentorship success and point out opportunities for development.

5.5.8 Integration with Mentorship Platforms Already in Use

The adoption and deployment of the approach can be expedited by integrating it with current learning management systems and mentorship platforms. Broader use and wider dissemination of the model's advantages can be achieved through smooth integration with popular platforms.

In summary, even though the Mentor Buddy Matching Model has shown a great deal of promise in improving mentorship programs, there is still much need for further study and advancement. Researchers and practitioners can continue to improve the model and optimize its influence on mentor-mentee interactions by investigating these areas.

5.6 Conclusion

Because of its influence on both professional and personal development, mentoring optimization has grown to be a prominent field of study. The researcher used machine learning techniques to create the Mentor Buddy Matching Model in order to overcome the issues that traditional mentorship programs confront. In order to find distinctive patterns and classification factors for successful mentor-mentee pairings, this study examines a variety of participant characteristics and replies.

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The study suggests a thorough Mentor Buddy Matching Model and Framework to address these issues, combining a number of functions frequently seen in machine learning-based classification systems. An extensive dataset defines the research's scope and guarantees a comprehensive portrayal of mentor-mentee dynamics. The pseudo code described in this thesis is used to construct the model and framework, making use of a number of data processing and analysis tools.

To ascertain its performance, the Mentor Buddy Matching Model was put through a thorough testing and evaluation process. The outcomes showed that the model was successful in correctly categorizing and pairing mentors and mentees, with satisfactory success rates. This chapter provides a detailed presentation of the model's performance evaluation, including accuracy, speed, and effectiveness.